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EARL C. ELKINS, M.D.

Rochester, Minnesota

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EXPERIMENTS ON THEORY AND THERAPY OF SHOCK *

FREDERICK M. ALLEN, M.D.

From the Department of Physiology and Biochemistry
New York Medical College

NEW YORK, N. Y.

Owing to the military urgency of the shock problem as well as the special delays and difficulties of publication in wartime, it seems desirable to publish a summary of results obtained in a rather extensive series of experiments, instead of following the scientifically preferable course of awaiting the appearance of three detailed papers in the *American Journal of Surgery* from June into the fall of this year.

The word shock will be used entirely in the sense of "secondary" shock, the conception of which may be expressed in an abbreviation of Moon's[1] definition: Shock is a disturbance of fluid balance resulting in a peripheral circulatory deficiency manifested by reduced volume and flow and increased concentration of the blood, with anoxia.

The study was mostly conducted with the form of experimental shock which I introduced in 1939,[2] produced by temporary ligation of limbs. The advantages are that it is a relatively "pure" form of shock, its causation involving nothing except the processes of reduced oxidation and fluid shift which are included in the definition. Nervous factors are excluded by paralysis of nerves, and rat tests show anesthesia to be immaterial. Recovery in survival experiments can be complete. Standardization can be precisely controlled through two variables, namely, the mass of tissue ligated and the duration. In average rats, high ligation of one hind leg creates a border condition, which can be nonfatal or fatal according to whether fluid is or is not supplied. Four hour ligation of two legs or longer ligation of one or two legs causes shock of increased severity. Dogs and cats die after ligation of one hind leg for nine hours or of both hind legs for six hours. The shock can be graded to vary the duration of survival. Experiments with this comparatively uncomplicated shock have been checked by comparison with three standard methods, namely, muscle trauma, burns and hemorrhage, all of which introduce serious and confusing complications.

My observation published in 1937[3] and 1939[2] that shock of local origin can be prevented by refrigerating the site of origin has been confirmed by a number of writers experimentally and clinically. Adoption of this method for treatment of existing shock has been discouraged by the experiments of Blalock,[4] who found a lengthening of survival but no final prevention of death in dogs shocked by muscle trauma. These general findings are readily verified, though some questions may be raised concerning the degree of standardization, the possibility of too severe shock to permit of any large scale recovery even with considerable benefit of treatment and the chance of intoxication from necrotic or infected muscle in the later stages. Mainly, however, since cold delays but does not finally prevent the edema of the hind legs, Blalock's own theory of shock explains why hemoconcentration, shock symptoms and death are only retarded and not avoided. The therapeutic fallacy consists in assuming that a patient would be left without other treatment than cold, or that it is a fair experiment to permit death from

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dehydration due to edema formation. When animals in various grades of shock are merely supplied liberally with fluid, in the form of water by stomach tube or saline solution subcutaneously, the results are transformed. With sufficiently severe shock the untreated controls die without absorbing any effective quantity of fluid, but the dogs with refrigerated legs remain strong and lively long enough to profit by the fluid, so that they not only live permanently but often escape serious symptoms. Local refrigeration can therefore be recommended as a safe and powerful aid in the treatment of shock of local origin, not as a sole cure but as a means of retarding symptoms and gaining a respite during which other medical or surgical treatment can be used effectively. Besides limb wounds, it is beneficial for superficial lesions of all parts of the body, especially burns[5] and frostbite.[6]

While the problem of optimum local and systemic temperatures in shock is being actively studied and the harmful overheating of the recent past will be stopped, the fact remains that these measures are accessory and that the severest shock must be treated otherwise, often unsuccessfully. Three dicta prevail in this subject. First, the most efficient treatment of shock is fluid administration. Second, the most valuable fluid is blood, plasma or a colloid substitute, salt solutions being inferior because they leave the circulation rapidly and carry out additional plasma protein. Third, shock which is sufficiently severe in its initial character or has advanced to a sufficiently advanced stage is irreversible and hopeless under any treatment. These beliefs have long been universal, without a single dissent.

My paper of January, 1939[2] devoted space to the hypothesis that the inflammatory reaction to a local injury is equivalent to shock when it merely becomes large enough to cause systemic symptoms. This manuscript was submitted before the publication of Moon's 1938 book,[7] which compressed this idea into the aphorism "The wheal is shock in miniature." Though Moon thus furnished the most concise and felicitous expression, he failed to draw the therapeutic conclusion which I had deduced theoretically and experimentally. Assume that shock is merely an enlargement of what occurs when a man hits his thumb with a hammer. If injured tissue has an inherent tendency or need to swell by absorbing fluid, is it rational therapy to administer a fluid which will remain most firmly within the vessels, or on the contrary to give one which will pass most readily through the vessel walls to supply the tissue demand? Conceivably, the injury may alter the specific endothelial permeability, or it may cause a discharge of vasodilator or water-attracting metabolites in the tissues, or it may do both. The physiologic term of tissue need or avidity, and the physiochemical conception of osmotic balance or membrane permeability, doubtless are synonymous fundamentally, but they convey different superficial impressions. The idea of vascular permeability has universally been interpreted to mean that the leaky vessels will continue to pour out fluid without limit until the organism is drowned or the blood protein fatally depleted. The idea of tissue need implies that the migration of fluid will stop when the need is satisfied. My rat experiments published in 1939 proved the latter conception to be true.

The essential and crucial problem in shock is that of reversibility. The experiments mentioned showed simple physiologic salt solution to be superior to blood, plasma or other colloids because it arrested or reversed the shock process and saved the animals in severe states when the latter fluids caused only useless plethora. The experimental and clinical literature are summed up in one stereotyped complaint: "I have given large saline infusions and they do not prevent hemoconcentration and only carry protein with them out of the vessels." There is reason to answer: "Excellent. Now

continue to give more saline solution until the tissue demands are satisfied, so that fluid remains in the vessels and hemoconcentration is abolished." In the previous experiments, the observations of a still more extreme degree of shock which was uncontrollable even by this method were perhaps explainable by lack of constitutional strength or by technical difficulties in dealing with rats. The recent experiments with dogs establish the conclusion that shock in this species is reversible regardless of stage or severity.

The literature contains plentiful proofs of the mutually augmenting effect of shock and anesthetics, including barbiturates. Anybody can quickly convince himself that an animal in severe shock is anesthetized by a fractional dose of a barbiturate, while a full normal dose is hopelessly fatal. It is likewise fatal to induce severe shock at the height of the influence of a full dose of a barbiturate. The symptoms of the two conditions are identical in so many respects as to lend corroboration to the warnings of Moon, Mann, Muirhead[8] and others that many authors who thought they were studying shock were observing chiefly narcotic poisoning. Much confusion is cleared up by discarding the numerous publications based on these errors. Such a sweeping rejection for this technical flaw may include, for example, all the elaborate data of Wiggers[9] on the circulation in shock. As regards the present topic of reversibility, however, the observations of Wiggers on anesthetized animals and of Blalock[10] on unanesthetized animals agree with all other experiments, including my own, in showing that life cannot be saved in the most severe degree or stage of shock by injections of blood, plasma or other colloids. This unanimous teaching of irreversibility is only disproved by resorting to a form of experiment which no authors have tried in the absence of anesthetic or other errors.

Such experiments are available in shock produced by leg ligation, muscle trauma, burns and hemorrhage. Clearcut results and permanent survival are favored by the relative purity of the first form. Muscle trauma involves hemorrhage and the chance of delayed death from necrotic or infected muscle. Burns are well known as causing toxic or pneumonic death after the actual shock period is past. Regarding hemorrhage, authors are wrong in arguing that it is immaterial whether circulating fluid escapes into the tissues or outside the body. A large blood loss interferes technically with the convenient method of judging hemoconcentration by corpuscle estimations, and, more important, it can cause death from anemia or it can finally be cured only by a blood transfusion, which is unnecessary in pure shock.

Nevertheless, the procedure in treating any of these forms of shock consists in waiting until any desired combination of clinical and laboratory tests indicates that the condition is thoroughly hopeless. Death in every form of true shock invariably occurs by apnea, while the heart continues to beat rather strongly and then fades out. In order to settle any doubts about severity without complicated data and apparatus, a more extreme test has been adopted than was ever set up for any previous therapeutic method, namely, at least one animal in every group has been allowed to "die." This means that after exposure of one jugular vein, the condition is allowed to progress to the final apnea; then before the heart stops beating a rapid injection into the vein is begun. Revival is not possible after the heart has actually stopped, but it has been obtained in some instances when no heart action was palpable and when artificial respiration and thoracic massage for five minutes were necessary to bring a feeble return of function. When the method is properly carried out at the proper time, it restores every dying or "dead" animal, without a failure or exception.

The most rapid and spectacular transformation is obtained by a procedure which is subsequently fatal in itself, namely, infusion of excessively large volumes of physiologic saline or Ringer solution. This has been given sometimes as a continuous flow, but usually spaced injections have been preferred to make possible the observation of the effect of each. A typical experiment, not of the most rapid character possible, is illustrated in the accompanying table.

Experiment With Dog Weighing 6.5 Kg.

Day of Experiment	Hour	Saline Solution, cc.	Urine, cc.	Red Cells, Millions	Incidental Notes
1	7:00 a. m.	.....	.....	5.6	Soluble pentobarbital U. S. P., 150 mg. intraperitoneally
	7:15 a. m.	.....	.....	....	Both hind legs ligated
	2:15 p. m.	.....	.....	6.4	Dog awake, active; tourniquets removed (7 hr.)
	3:45 p. m.	.....	.....	7.7	Progressive weakness
	5:30 p. m.	.....	.....	9.2	Ear vein blood very dark and scanty; blood pressure unobtainable by auscultation; dog limp, apathetic; takes no notice as right jugular is exposed; blood in feces
	6:40 p. m.	.....	.....	....	Unconsciousness without eye reflex; terminal apnea; heart nearly stopped
	6:40 to 6:50 p. m.	600	.....	....	Breathing and heart restored; unconsciousness
	7:30 p. m.	.....	.....	7.6	persists
	7:30 to 7:40 p. m.	500	.....	....	Improvement in heart and respiration
	8:15 p. m.	.....	120	7.1	Progressive swelling of thighs
	9:30 to 9:40 p. m.	400	.....	....	Dog dimly conscious, weak
	10:15 p. m.	.....	270	6.8	Flow from ear vein brighter and more abundant
	11:15 p. m.	400	.....	....	Dog able to stand feebly; tries unsuccessfully to drink
2	12:45 a. m.	.....	340	5.9	Huge thigh edema extends over flanks; ear vein blood copious, arterial red color
	2:30 to 2:40 a. m.	400	.....	....	Strength increased; dog drinks 200 cc. of water; still thirsty
	3:40 a. m.	.....	410	5.2	450 cc. of water at intervals; dog still thirsty
	5:00 to 5:10 a. m.	400	380	....	630 cc. of water at intervals
	6:30 a. m.	.....	270	4.7	Occasional diarrhea, free from blood; brachial pressure by auscultation 136/88; sounds very clear
	9:00 a. m.	.....	320	4.4	340 cc. of water at intervals
	12:00 noon	.....	260	4.6	Dog walks well and seems fairly strong, though depressed; refuses food; brachial pressure 128/80
	5:00 p. m.	.....	230	4.8	Strength less; enormous edema has spread from thighs to thorax
	5:00 to 5:10 p. m.	400	.....	....	Strength slightly better after injection; occasional small diarrheal movement without blood
	8:00 p. m.	.....	200	4.2	225 cc. of water; ear vein pricks continue to bring profuse bright red blood flow
	10:30 p. m.	.....	140	4.5	Strength failing
3	1:00 a. m.	.....	110	4.6	Strength still less; auscultatory blood pressure unobtainable
	3:15 to 3:25 a. m.	400	.....	....	Condition unchanged; dog refuses water
	5:00 a. m.	.....	90	3.9	Dog dangerously weak; unable to stand
	5:40 a. m.	.....	.....	....	Death

NOTE — The saline injections within about thirty-two and one-half hours totaled 3,500 cc., or slightly over one-half of the body weight. Drinking of 1,845 cc. water raised the total fluid intake to 5,345 cc., or about four-fifths of the body weight. With 3,140 cc. urine subtracted, the net fluid addition was 2.2 Kg. The body at death weighed 8.4 Kg., this weight representing a gain of 1.9 Kg. over the initial weight. The difference is presumably accounted for by diarrhea, evaporation, etc.

Autopsy confirmed the extreme edema spreading from the thighs over the thorax to the axillas. The thoracic and peritoneal cavities contained no measurable fluid. Pulmonary edema was the evident cause of death. The heart and great vessels were full of thin-appearing blood, which clotted within normal time but with reduced fibrin. All viscera were normal except for general wetness and retroperitoneal edema. The intestinal mucosa was not engorged, and the fluid contents were not bloody.

The typical result shown in this experiment is that an animal which is ready to die from shock in four or five hours after removal of the leg tourniquets is revived from its dying state and restored to consciousness and fair strength, but after a considerable time (thirty-five hours in this instance) inevitable death occurs from a condition which is opposite to shock in all the cardinal features enumerated hereafter.

Observations showed that such death may be due partly to the treatment, and that panic over the critical state of shock or the striving for speedy dramatic transformation may lead to fatal excess in treatment. The least quantities of salt solution which will keep hemoconcentration in these animals within moderate bounds are still greater in proportion to body weight than have ever been used in treatment of human beings. With such quantities of infusion, permanent survival has been obtained in dying animals and in others at such advanced stages of shock that they could not have been saved by plasma. Although experimental shock thus seems to be invariably reversible at all stages up to the instant of death, the observations are not to be construed to mean that life can always be saved, i. e., that shock can always be overcome by a quantity of saline solution which will not be fatal in itself. Obviously, the extraneous injuries of burns or other complications of shock should be excluded.

These findings, which can be readily verified within a day or two by any laboratory worker, aid in clarifying the knowledge of shock by showing that most of the traditional teachings are unfounded or diametrically opposite to the truth. The immediate importance of the shock problem with reference to therapeutic needs in war and also in relation to numerous other researches in progress must serve as justification for sharp concise statements, which are intended not to be arbitrary or offensive but only to express facts and opinions clearly so that they can be either used or disproved by others.

As already mentioned, it is untrue that shock is irreversible at any stage. That plasma or any other colloid solution is therapeutically superior to crystalloids is opposite to the truth. It is untrue that infused salt solution continues to leak out into the tissues without limit. It is untrue that the escape of plasma protein along with the saline solution into the tissues serves to increase hemoconcentration; there is evident absurdity in trying to hold hypoproteinemia responsible for both the hemoconcentration of shock and the hydremia of certain familiar clinical states. It is untrue that an abnormal increase of general vascular permeability exists even in the most advanced stage of shock.

Obviously these matters cannot be adequately discussed in small space. Also the same causes which have held back this entire work for many years have necessitated carrying it out strictly alone and unaided. Therefore it is necessary to mention the evidence which could be obtained under these limited conditions to oppose the conclusions of the highly organized and financed institutions. Beginning with normal animals, the high tolerance for rapid massive saline infusions is illustrated in the statement of Cutting and associates[11] that the tolerated dosage in cats would correspond to 35 liters for a 70 Kg. man, injected at the rate of 350 cc. per minute. Such animals either die or recover quickly, with a rather sharp limit of volume tolerated. Besides the limited excretion through urine and diarrhea and the general tissue retention, there may be a filling of the stomach with fluid which in an unconscious animal may cause a fatal accident of regurgitation and aspiration; with sufficiently large infusions a tense ascites develops, and a fatal dosage causes death by edema not of the brain but of the lungs. It is interesting

to make a comparison with shocked animals, in which exudation is already in progress in the lungs, intestine and other regions, as shown by Moon and others. The fact is that shocked animals develop less ascites than normal controls, and although they may die from pulmonary edema the tendency is (as already mentioned by Davis[12]) less than in normal animals. Furthermore, the observation that a small dog nearly dead from shock can receive an infusion of a liter or more of saline solution within ten or fifteen minutes and dispose of it, not only as efficiently as a normal dog but with obvious benefit, is an added reason for clinging to the definition of shock as a capillary process and for skepticism concerning alleged factors of cardiac or vasomotor failure.

Injuries such as local asphyxia, muscle trauma and burns create abnormal permeability of the local blood vessels, and the resulting edema is exaggerated by large saline infusions to a degree far exceeding anything ever found otherwise. This local area serves as a safety valve or a dumping place for excess fluid, which accounts for the reduced tendency to effusion in the peritoneum or lungs. This is a convenient test of vascular permeability; i. e., if capillary permeability is increased by any means anywhere in the body, large saline infusions will cause a marked outpouring of fluid in that region. This test positively disproves an increased permeability of the general vascular system at any stage of any of the four types of shock studied. Also, it is not true that the vascular leakage in the damaged area is unlimited. When the fluid demand is satisfied, a new equilibrium becomes established between blood and exudate on a basis which may be abnormal but still readily compatible with life. Every additional saline infusion breaks this equilibrium and increases the exudate; otherwise no additional effusion occurs and a process of absorption gradually supervenes.

The universal doctrine that the special leakiness of the blood vessels in shock makes crystalloid solutions specially incapable of maintaining an adequate volume of circulating fluid is opposite to the truth. Corpuscle counts in normal animals show that large saline infusions are disposed of so that the temporary blood dilution is rapidly overcome. In shocked animals the dilution may be of much higher degree than in the example shown in the accompanying table, and it persists through and beyond the duration of shock, sometimes for several days, until the animal either dies or recovers. The idea that hemoconcentration is aggravated by the washing out of plasma protein is opposite to the truth; a better statement is that injected saline solution specifically cures shock by converting it into hypoproteinemia, with the naturally accompanying hydremia.

To demonstrate the specific antidotal action, it was necessary to show correction of vasoconstriction, oligemia and anoxia under conditions which made the requisite data unobtainable. The deficiency of filling and of volume flow in both arteries and veins in severe shock is obvious on the most casual inspection or compression; there is notoriously little bleeding if capillary areas are incised, and cutting of an ear vein yields only scanty blood or none. After sufficient saline injections the blood vessels remain obviously full and incisions bleed even more copiously than normal. The thin blood shows reduced fibrin content but not the delayed clotting which has been described in shock. Particularly, in the severest shock the arterial blood looks as dark as normal venous blood, the venous blood is dark purple and oxygen administration and all other measures have failed to overcome this anoxemia. But after the largest saline injections the profuse bleeding from a cut ear vein is as bright as normal arterial blood, and the transformed state of the animal indicates that the oxygen is utilized, i. e., both

anoxemia and anoxia are overcome. This evidence, though crude, suffices for positive proof that the cardinal features of shock are corrected or overcorrected.

Two additional errors of those who have regarded hemorrhage as identical with shock are seen in the facts, first, that the plasma loss outside the body is not only unrecoverable after shock but is not available for forming the previously described equilibrium between circulating fluid and exudate during shock; second, that an electrolyte solution which specifically cures shock cannot be a cure for hemorrhage, which specifically requires blood, plasma or an effective colloid substitute. Study of a theoretically pure form of shock is needed to distinguish between the condition and the complication. Since Pilcher and Sollmann's[13] experiments in 1914 it has been known that at a certain late stage following hemorrhage the blood pressure is not raised or life saved by transfusion of any quantity of blood. Any one can quickly convince himself that in this stage of true shock, physiologic salt solution is superior to blood, in that it can both restore blood pressure and save life. After hours or days the animal may then die from simple anemia unless saved by transfusion. On the other hand, in the acute stage of hemorrhage only blood or a colloid substitute can restore a normal state. This does not mean, however, that saline solution is as useless as is taught. The alleged objection is that it passes out of the blood vessels too rapidly to furnish more than evanescent benefit. But if the saline solution thus leaves the circulation, there must be room in the circulation for more; therefore why not continue the benefit by continuing the infusion? Experiments with animals bled to the point of quick death show that it is possible thus to establish a new equilibrium between blood and tissues, when the fluid ceases to leave the blood vessels and a circulating volume compatible with life is maintained. The minimum limit for either plasma or corpuscles has not been ascertained, but the margin between immediate hemorrhagic death on the one hand and drowning in salt solution on the other hand appears to be rather wide. According to conditions, the dying animal may be enabled to live for an hour, a day or a week. Therefore, if the bleeding has been stopped and there is delay in obtaining blood or a colloid substitute, large saline infusions are by no means useless even for acute hemorrhage.

The blistering and oozing of burns furnish a different example of depletion of blood proteins by loss to the outside. Historically, however, the first recognized process of this kind was in the rice water stools resulting from the inflamed intestinal capillaries in cholera. Two factors govern the protein content of exudates: first, the degree of injury of the blood vessels; and, second, the quantity of available fluid. The introduction of the unfortunate and unproved colloid concept with gum arabic in the first World War saddled both investigators and clinicians with an obsession of treating the blood instead of the shock. Transfusions of blood or plasma may presumably have some value to restore the blood in cholera, but also presumably they would not equal the benefit of much larger saline infusions, even though these infusions carry out additional blood protein into the bowel. Analyses which I shall offer contradict the idea that the exudate in shock or burns is necessarily equivalent to plasma when ample saline solution is available; but on the other hand they confirm the fact that in spite of reduced percentage the total outpouring of protein is increased by the saline infusions. The life-saving value of the infusions remains unaltered. The depletion of blood protein may then be corrected by proper measures as a secondary detail.

That shock is not thus confused with mere dehydration can be proved by the fact that in the severest stage of shock an injection of isotonic dextrose solution is acutely fatal. The superiority of physiologic saline or Ringer solution over plasma or various crystalloids or electrolytes, as regards blood pressure, blood oxygenation and relief of symptoms, and also the thirst of the treated animals (while normal controls given similar infusions firmly decline to drink anything), indicate a specific need of the shocked organism for both water and sodium chloride. In this respect plasma may be regarded as a muddy saline solution; it is beneficial to some extent in spite of its protein contamination, which both hinders its diffusion and forbids its use in adequate quantities. Two broader relationships may be perceived. First, the physiologic role of sodium chloride in fine vascular processes and fluid interchanges is in accord with its dominant influence on pathologic circulatory conditions such as shock, edema and (as I have pointed out for many years) hypertension. Second, although existing organic damage may be beyond remedy, the greatest danger often lies in progressiveness, which in three conditions I have shown to be checked by removal of a functional cause. My first declaration that the progressiveness of diabetes is arrested by relief of pancreatic overstrain was not believed at a time when the disease was universally regarded as inherently progressive. Hypertension does not progress when controlled by salt-free diet.[14] Shock does not progress and is reversible in the hydrodynamic aspect when the tissue need for salt and water is supplied, even though nerve or tissue injuries may later prove fatal.

In regard to practical application, it is not expected that animals can be saved from every degree and stage of shock with injections of salt solution for mere hydrodynamic restoration. The obstacles which prevented completion of the experiments before the outbreak of war have likewise prevented clinical trials up to the present. Presumably, the experimental results are most closely applicable to acute shock in young laborers or soldiers, who most nearly resemble healthy animals. Caution is imposed by the fact that the susceptibility to edema, including edema of the brain and lungs, is greater in human beings than in dogs or cats. Treatment with saline infusions may be limited or sometimes contraindicated in the presence of complications such as cardiorenal-vascular disease, senility or the hypoproteinemia described by Abbott and Mellors.[15] Aids for overcoming these difficulties may be sought in transfusions to improve the quality of the blood, and perhaps in hormones or drugs; at any rate there is reason to hope that the dangers created by saline solution may be more easily mastered than the dangers of shock without saline solution. In suitable cases, the special value of adjuvant treatment with temperature reduction will consist in reducing the need for salt solution as regards both speed and quantity. One practical effect of the saline treatment, if successful, will be to reduce enormously the present use of plasma and thus leave a more abundant supply for cases of real necessity. But, as the benefits of plasma are definite and established, the trials of the radical saline treatment should be limited to shock cases which are admittedly hopeless under prevailing methods.

Conclusion

Experiments indicate that refrigeration of any accessible region from which shock originates (wounds of the limbs; burns anywhere) is helpful for retarding the development of shock and gaining time for benefit by other treatment. By administration of sufficient salt solution, experimental shock is controllable and reversible (even if not finally curable) at every stage up

to death; also, the temporary usefulness in acute hemorrhage is greater than commonly supposed. The findings are believed to have extensive theoretic implications and also to warrant clinical trials in cases now hopeless.

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1031 Fifth Avenue, New York City.

RAPID REHABILITATION FOLLOWING CERTAIN SHOULDER FRACTURES *

HAROLD LEFKOE, M.A., M.D., D.N.B., A.I.C.S.

Associate in Charge of Orthopedic Surgery at St. Lukes' and Children's Medical Center;
Associate Orthopedic Surgeon at Jewish Hospital;
Assistant in Orthopedic Surgery at St. Joseph's Hospital

PHILADELPHIA, PA.

The ambulatory method of treating certain fractures of the humerus is not new. It was not, however, until ten years ago that papers began to appear in the literature advocating the use of a method of treatment which apparently violated that key rule in fracture treatment—immobilization, complete and thorough, of the fragments.

In spite of the use of these methods by many clinics during the intervening years, personal experience leads us to believe that, even had we nothing more to offer than a reiteration of the value of this method, there would still be a place for this paper. We still see in our experience, too many stiff, painful shoulders due to the type of treatment received rather than to the nature of the fracture itself. There is in our opinion rarely any justification for the occurrence of this syndrome following shoulder trauma. The use of the method which is known (in the absence of the lexicographic purist) as the "hanging cast method" has revolutionized the prognosis of shoulder injuries in our hands. We have, we hope, contributed our own bit of improvement to the method, thus eking out every last modicum of advantage it affords.

Diagnosis

There are some who use the hanging cast in any fracture of the humerus, regardless of severity, type or degree of rotation and angulation of the proximal fragment. To those with this view, the roentgram is only a matter of academic interest. While we admit that we are well on the way to the even wider use of the method, we still feel that roentgrams should be taken in every case.

Many shoulder fractures are of the three-dimensional variety. A certain group are complicated by dislocation. For accurate diagnosis of the relative positions of the fragments, careful roentgen studies are necessary. While stereoscopic views are frequently taken, their value is limited by the rarity of the apparatus with which to read them and by the experience of the reader in interpreting what he sees, as well as by his ability to communicate his knowledge to a surgeon not so well versed in reading such a set of films.

The lateral view most frequently taken is an oblique one, with the film held firmly over the shoulder and a shock-proof tube placed in the axilla. The taking of this view, however, violates our contention that meddlesome passive motion of the shoulder is unforgiveable and that the preliminary determination of the condition which is to be treated is to be known with as little manipulation as possible.

A possible fracture of the shoulder is usually seen first by the family doctor, the intern, or some enthusiastic first aider, each of whom will usually immobilize the arm to the side with a swathe, a velpeau or a cravat, depending on his training. The lateral view which does not compel the dis-

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turbance of such a dressing is that taken through the entire thorax. It is best taken with the patient standing, the Buckey diaphragm being used, and with the same technic as is used in the taking of the lateral spine. Even in the thick-chested person it is possible to get excellent views, for the broader the chest, the more air is there for the rays to traverse. The opposite arm is held out of the way, above the head.

Suggested Indications

This paper will not concern itself with the fracture of the surgical neck of the humerus with or without dislocation of the head, in which there is extreme rotation of the head and 100 per cent displacement of the shaft, the so-called "unimpacted fracture." Neither will we discuss epiphyseal separation with marked displacement, with impossible realignment of the fragments. A forthcoming paper will discuss our results with the former type; our experience with the latter type has been insufficient. We have used and wish to present the proposed treatment for all other types of fracture around the shoulder joint, including:

1. Fracture of the greater humeral tuberosity. This does not include the so-called tear fracture which on clinical examination amounts to a tear of the supraspinatus insertion. These cases should be treated by immobilization in the so-called "salute position."
2. Comminuted fractures of the humeral head.
3. Fractures of the surgical neck of the humerus. These include the linear, the impacted, and the complete fractures with any displacement of the shaft less than 100 per cent.
4. Fracture of the tip of the clavicle.
5. Separation of the distal acromial epiphysis.
6. Fracture of the body of the scapula in good position.

We have also utilized the treatment immediately after shoulder dislocation with reduction.

Technic

The technic of application of the hanging plaster cast has been adequately described by other authors.[5-7-21] It should extend as high up into the axilla as possible. We carry a small shelf down as a prolongation along the ulnar surface of the hand, and extend it as far as the metacarpophalangeal joint. Since the forearm is in neutral position, this rest prevents a dropping of the wrist to the ulnar side, pressure from such a position or fatigue from holding the hand straight. We see no particular reason for applying a poorly padded plaster, and find that extra layers of sheet wadding over the bony elbow prominences are much appreciated. The ring at the wrist we make most conveniently of plaster bandage. We suspend the arm and forearm from the neck, using muslin bandage, and protect the back of the neck with a strip of piano felt ¼ to ⅜ inches thick.

With this method the patient can lean forward and do pendulum exercises painlessly an hour after the application of the plaster. We encourage patients to do this at home; they return to us at the end of three days, and on the fourth day after fracture we utilize our own variant of the hanging plaster method. We bring into play the intensive use of guided active motion after gentle heat and sedative massage.

The patient is allowed to lie supine on a hard mattress on the routine wooden treatment table. With the hanging plaster on the upper extremity as previously described, there is no pain as the patient lies down. The arm assumes its position on the mattress by the patient's side, and the forearm

rests on his chest. The patient is assured that he will not be hurt, and the proposed treatment is outlined to him on the first visit. We find this to be a very important factor in the early treatments.

With the patient turned slightly over on the uninvolved side, local heat is applied to the shoulder area and the pectoral muscles. We have used both infra-red light and the paraffin pack for this purpose. Though we are ardent advocates of paraffin, we cannot find in this type of case any real advantage that outweighs the difficulty of application. The mild heat is then followed by a sedative centripetal massage, and this leaves the shoulder area completely relaxed in most cases.

The patient is once again placed supine, with no pillow allowed unless this is contraindicated by dyspnea. In that case we try to do with a pillow placed under the head but not under the shoulder. Facing the patient and standing or seated at his side, one places the hand nearest his body under his shoulder blade with the palm up, and gently but firmly grasps his shoulder, thus immobilizing the scapula. The other hand then gently turns the humerus into neutral position, with the fingers pointing straight toward the ceiling, and at the same time supports the weight of the extremity at the elbow. With the scapula fixed, the first attempts at abduction increase rapidly, and the extent is greatly increased by the active guidance of the surgeon's hand.

At no time is pain produced. After abduction to as great an extent as possible, the same technic is used in obtaining internal and external rotation of the still abducted arm. Then the scapula is freed, and the principle of guided active motion is again utilized to bring the arm into adduction and into flexion. Finally the patient is shown how to obtain internal rotation by placing the forearm behind the back. The extent of all of these motions is to the point of guided active motion—at no time is passive motion employed. This performance is repeated daily, for we still argue against the convenient or expedient use of physical therapy "every other day."

The plaster is removed routinely at the end of two weeks. From that time on the same treatment is followed, though as soon as we see that a patient is cooperating, we do not supervise him so closely, and turn more and more responsibility over to him at home. We now encourage active elevation, and also hanging from horizontal bars—but still do not allow any of these exercises to be carried to the point of pain.

Some of our patients are discharged at the end of four weeks after application of the plaster, but the majority are discharged sometime in the fifth week. Rarely do we find it necessary to keep one under supervision for eight weeks. Discharge is given only when the shoulder is painless and completely functioning, with no more than 10 degrees of limitation in any active shoulder motion. Of 35 patients treated by this method, not one was forced to have a forceable manipulation under anesthesia.

Comment

In 1932 Sumner Roberts[22] called attention to the poor end results so frequently seen after fractures of the surgical and anatomic neck of the humerus. He himself advocated early motion and lamented the scant attention paid to Just Lucas-Championniere, whose teaching in France in 1886 was brought to the United States by Mennell in 1911.[19] Meanwhile, the extension splint of Hamilton,[2] a means of ambulatory treatment with adhesive plaster traction and weight extension, was known but apparently not widely used. Most of the textbooks and reference books, however, agreed with Speed,[26] that shoulder dislocations should be immobilized two to three weeks,

and fractures of the shoulder required complete rest of that joint for four to five weeks. Only rarely did one find a Scudder[25] crying that the customary immobilization for many weeks gave poor results, and advising motion from the very first day after reduction of a dislocation, and no restraint whatever at the end of ten days.

The erroneous belief that a limb must be placed in a certain position to meet the supposed requirements of a short proximal fragment which is being uncontrollably displaced was still widespread,[6-27] Mennell,[19] Lucas-Championiere[19] and Russell[24] to the contrary notwithstanding.

Jones and Lovett[14] were among the first to emphasize that in fractures of the upper end of the humerus the importance of perfect alignment is overshadowed by the problem of early restoration of the full range of motion in the shoulder joint. In 1933 two reports appeared simultaneously[5-23] both simply mentioning for certain types of fractures the use of the hanging plaster. This is the first time we find the name mentioned in the literature. Anderson[1] affirmed a year later that even in cases of marked rotation of the head with complete displacement, once a certain approximation of the two surfaces is obtained there is little tendency to slipping of the fragments.

In the late thirties and early forties papers from several groups[4-7-10-11-16-17-21] appeared in rapid succession on the subject of the hanging plaster cast in the treatment of certain fractures of the humerus. All the reports were favorable.[13-28-29] They emphasized the value of the treatment in securing unusually good function, and unanimously considered this as the outstanding feature of the method. Other advantages included the avoidance of airplane splints and spica plasters, the ambulant treatment with reduction of hospitalization to a minimum and the reduction of the amount of "artificial physical therapy" required. To the last we take exception. In our experience, probably more time and carefully centered attention is required in the proper administration of physical therapy in these cases than is required in any other type of fracture follow-up.

We have long been of the same mind as Murray,[20] that physical therapy in the treatment of fractures should have as its purpose to minimize the length of the recovery period, rather than to prolong the convalesence. This end result we believe depends on how early we can elicit active functional exercise by utilizing the well known principles of guided active motion, feeling with Kraus[15] that active motion should be used for every injured section as soon as it can be employed without jeopardizing normal anatomy and without pain.

Magnuson[18] is one of the few who mention the tremendous amount of muscle spasm which develops so quickly in the shoulder after trauma. We wish to emphasize this fact, for we feel that the hanging plaster has an outstanding feature in that its traction relaxes the muscle spasm rapidly, and thus the shoulder lends itself readily to guided active motion. The relaxation of muscle spasm by prolonged mild traction has long been a fundamental principle of orthopedic surgery and of physical therapy. This muscle spasm is the result of irritation of the reflex arc by the trauma. It was this premise, plus the realization of the poor results following immediate reduction with prolonged fixation, as reported by Wilson[27] and Gray,[9] and seen by ourselves, that made us include reduced dislocations without nerve injury as the same underlying problem, to be treated in the identical manner. In spite of the warning of Caldwell[3] and the older fears of recurrent dislocation, we agree with Gray and with Wilson that the end results are much better when treatment is carried out without immobilization of the shoulder joint.

The emphasis on early guided motion may not be new but certainly has never been emphasized in the literature of shoulder joint disability. Kraus[15] bemoans the fact that, while active motion in the treatment of injuries has been generally accepted, its practical use is still unsatisfactory. This should not be begun, in our opinion, until the acute inflammatory reaction has subsided. It is generally accepted that after an acute injury there is a tremendous hemorrhage. In the shoulder, the fascial planes are such that the hemorrhage spreads over a wide area, into the thoracic wall by way of the pectorals and the teres muscles, and into the shoulder cap, as well as down the arm. This hemorrhage, coupled with exudation and cellular infiltration, would go on rapidly to thickening and organization. In the presence of complete immobilization, this organization would occur in and between muscles and fascia shortened by spasm.

The stiff, painful shoulder which is so frequently seen after shoulder injuries has more than this as its foundation, however. Magnuson[18] describes beautifully the stretch paralysis of the abductors and the external rotators; Gurd[12] calls to our attention the fact that the deltoid is second only to the quadriceps in the rapidity of atrophy; we have all seen clinically the rapid contracture of the strong adductors and internal rotators and adhesion of the deltoid to the collapsed and self-adherent subdeltoid bursa; all combine with organization of the hemorrhage to prevent active motion of the shoulder joint. Adhesion of the long head of the biceps to the bicipital groove is debatable but may also be a fact.

With a full realization of these pathologic processes, we felt that the best way to prevent them was by guided active motion. Guidance, of course, is utilized to attain the very maximum of active ability. Preliminary heat will not cause reflex muscle spasm if it is kept mild and soothing. A subsequent light sedative massage is pleasantly relaxing. Now active muscle contracture will break up early adhesions throughout the entire range of the muscle and will restore normal circulation. Normal circulation aids in further active contracture of muscle, and this in turn initiates adequate venous and lymphatic circulation, both contributing to the rapid removal of infiltration and exudation.

Summary

1. The hanging plaster is a simple, effective, comfortable, ambulant method of treating certain fractures of the shoulder.

2. Guided active motion to a joint following trauma is the best method of preserving muscle strength, promoting circulation and preventing adhesion.

Conclusion

A technic in the treatment of certain fractures about the shoulder has been presented. It combines a satisfactory method of treatment of the local lesion with a desirable method of local physical therapy.

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1824 Spruce Street.

CEREBRAL BIRTH PALSY WITH SPECIAL REFERENCE TO PHYSICAL THERAPY

PAUL R. LIPSCOMB, M.D.,
Fellow in Orthopedic Surgery, The Mayo Foundation,
and
FRANK H. KRUSEN, M.D.,
Section on Physical Therapy, The Mayo Clinic
ROCHESTER, MINNESOTA

It has been only in the past ten or fifteen years that patients suffering from cerebral palsy have been receiving the attention which they so rightfully deserve. Phelps[1] has stated that one can expect to find 40 to 50 children per 100,000 of the population between the ages of 2 and 16 years with this condition. Since it is reasonable to suppose that there is an equal number of cases among adults, the probable number is somewhere in the neighborhood of 100 per 100,000 of the population. This means that 7 to 10 children per 100,000 of general population are born each year with cerebral palsy. Therefore, the importance of this condition among the crippling diseases is second only to that of infantile paralysis; and as methods for prevention of the latter disease are further developed, it is probable that cerebral birth palsy will rank first among the crippling disease of childhood.

Investigation of this problem is developing along the following lines:[2] (1) studies concerning the actual type of muscle or motor imbalance, (2) studies of localization of the hemorrhage or injury in the brain that causes the disturbance, (3) studies of ways and means of testing the true underlying mentality, (4) studies of the psychology of the different types within the group and (5) the application of medical, surgical, physical and occupational therapy to the problem. The last-mentioned approach calls for such a comprehensive knowledge in such varied fields of medicine and surgery that no one person can be intimately versed in all the ramifications. This is one of the chief reasons why the child who has cerebral palsy has been so shunted about and ignored by the medical profession.

In many instances, even if the mother of the patient consults a physician early, little is done for the child during the first few years of life. Too often, such children are dismissed with brief, perfunctory advice, with the result that the apprehensive parents consult the irregular practitioners of medicine. Needless to say, it is during the early years of life that treatment should be instituted.

There are essentially two types of cerebral birth palsy, the pyramidal and the extrapyramidal, which are to be distinguished from each other. Fulton,[3] who did some work with monkeys on the so-called pyramidal syndrome, has claimed that spasticity is unrelated to the pyramidal pathways and that it is a manifestation of release from extrapyramidal cortical projection. However, since this concept has not yet been generally accepted, we shall continue to speak of spasticity in this report as a manifestation of the pyramidal type of birth palsy and assume that this is due to destruction of the motor cortex. This is characterized by increased resistance to passive manipulation. In the extrapyramidal, or basal ganglion, type of rigidity, the quality

of resistance is different from that associated with the pyramidal type of birth palsy and the specific reflex changes are not conspicuous.[4]

Etiologic Factors

Cerebral birth palsy, or Little's disease, as it is more frequently called, is not a separate and distinct clinical entity, as no single cause can be found which applies indiscriminately to all cases. Asymmetric lesions are indicative of some factor that operates before birth. Neuropathic heredity, primary cerebral degeneration or developmental arrest, infection, premature birth, hemorrhagic disease of the newborn, asphyxia and anoxemia are considered to be causal factors in the symmetric lesions.

According to Brockway,[5] a history of long, hard labor or of the use of forceps is elicited in less than 50 per cent of cases. A history of difficult labor is found in probably less than 30 per cent of cases of diplegia. In Brockway's series of 1,000 cases there was a history of prolonged labor in 39 per cent, and in the cases of diplegia in 32 per cent. Although Carlson[6] pointed out that in 15 to 20 per cent of crippled children the condition is caused by intracranial hemorrhage, Phelps[1] said that poor obstetric supervision probably accounts for the crippling in less than 3 per cent of the total number. The other causes are unavoidable.

Observations

In an effort to evaluate and to classify the mental and physical conditions of patients with cerebral palsy and to determine the results of treatment as outlined at the Mayo Clinic for such cases we have studied 168 consecutive cases encountered in the years 1936 and 1937.

Approach to the Problem. — At the clinic, the patient is usually seen by a pediatrician, orthopedist, neurologist and one trained in evaluating the intelligence quotient. After the facts of the case are obtained and the diagnosis is established, the patient is referred to the department of physical therapy if it is felt that anything can be accomplished in this regard. In this department, the child's condition is further studied and the course of treatment is outlined. Treatment and instruction are then given by a registered physical therapy technician. Only in this way do we feel that we can evaluate the individual case and institute appropriate treatment. As most of the patients can stay for only one or two treatments, the parents are thoroughly instructed in the various exercises and how they should be carried out at home. We realize that in most instances this brief procedure cannot compare favorably with institutional training, but it is the best that we and most practicing physicians can offer.

Needless to say, the results of our course of treatment depend to a large extent on the parents. Naturally, we can expect very little from a doting, overbearing or neurotic parent, and all too often we see the spastic child entrusted to the care and training of such a person. This is pathetic in the case of the normal child; but it is heart breaking when a child with cerebral palsy is the one to suffer. Phelps[7] recently pointed out that the mother-child relationship is not so good as the teacher-pupil relationship and that one mother who had a child with cerebral palsy got much better results when teaching another mother's child who had spastic paralysis, and vice versa. Phelps added, "Get any one but the grandmother."

Sex. — The distribution of patients according to sex is about equal, males being affected slightly more often than females. Brockway[5] found 55 per cent of patients were males and 45 per cent females. These figures were

practically duplicated here; 55.6 per cent of our patients were males and 44.4 per cent females.

Age. — The average age when the patients in our series were first seen at the clinic was 8.56 years, comparatively late for treatment to be begun; whereas the age when symptoms were first noted, 4 patients aged 10, 13, 15 and 27 years, respectively, being omitted, was 10.9 months, and only 17.7 months if these 4 were included. The great majority of these patients had had no active treatment outlined for them before we saw them.

Clinical Distinctions. — If one takes into consideration the widespread nature of the lesions found at necropsy, it is not difficult to understand the wide variety of clinical findings. Nevertheless, it is important that we attempt to distinguish between hemiplegia and paraplegia, both clinically and pathologically. Heyman[8] pointed out that birth trauma probably plays a much larger role in the etiology of hemiplegia than in that of diplegia. The disturbance of muscle function in the upper extremities in cases of diplegia does not lead to contractures which are common with hemiplegia. The disturbance of muscle function in cases of diplegia is rather the result of loss of muscle control, athetosis, mass reaction and incoordination.

In our series of 168 evaluated cases, quadriplegia was present in 94, or 55.9 per cent, whereas Brockway[5] found quadriplegia present in only 28 per cent of cases. In our series there were 35 cases of hemiplegia (20.8 per cent), 66 per cent of which were of right hemiplegia and 34 per cent of left hemiplegia; whereas Brockway found that 32.4 per cent of his series were cases of hemiplegia, 56 per cent being of right hemiplegia and 44 per cent of left hemiplegia. We found 24 cases (15.5 per cent) of diplegia, 4 cases (2.5 per cent) of triplegia and 10 cases (5.9 per cent) of monoplegia; whereas Brockway found, respectively, 28 per cent, 1.8 per cent and 8.57 per cent of diplegia, triplegia and monoplegia. In our cases of monoplegia, the arms and legs were equally affected, whereas Brockway found the arm involved alone in 33 per cent and the leg alone in 67 per ecnt of cases.

Mental Status. — Formerly, the great majority of patients with cerebral palsy had the condition diagnosed and then were promptly dismissed from care without treatment. In addition, the association of mental deficiency with cerebral palsy was considered the rule. How often in the past has a child who has involuntary motion of his face resulting in grimaces, contortions and disturbances in the speech mechanism been considered feebleminded without further study? Absence of the ability to respond does not mean absence of intelligence.

The determination of the state of mentality is an exceedingly difficult procedure because the standard tests are based largely on motor activity. Because the child with cerebral palsy is unable to communicate with the normal person is no reason for not considering seriously some form of appropriate therapy, unless gross defects in mentality can be proved.

There exist no specific tests which can determine infallibly the underlying intelligence by means of motor response in these cases.[2] Rather, a combination of all tests must be used in determining the mentality and all parts of the body involved must be taken into consideration. The physiologic age of the body may not have kept pace with the chronologic age and only by a thorough study of all the developmental findings can such a difference be evaluated. One must sum up the emotional age, the social age and the mental age and then make allowance for the handicaps which exist. A great number of these patients improve mentally as their physical handicap improves through training and operative treatment.

As man learned to use tools and his hands became the master, develop-

ment of the brain and advances in civilization took place simultaneously. Among the majority of those handicapped from intracranial hemorrhage at birth, the backwardness can be accounted for by the lack in that process of development which proceeds by grasp and touch in every child. When the hand is difficult to control, an appreciable delay in the mental development of the child may result.

Phelps[1] reported that only 25 per cent show an intelligence quotient lower than 90 on special tests. Therefore, 75 per cent should be in the mentally normal classification. As methods of teaching are developed, this number is still further decreased.

In our series of 170 cases, only 45 (26.4 per cent) of the patients showed definite mental deficiency, although there were 55 (32.3 per cent) who, as nearly as we could determine, would be classified in the dull normal group. Including the latter group, this gives us a total of 73.6 per cent in whom treatment could be carried out with a hope of accomplishing satisfactory improvement. Phelps stated in a recent discourse that 69 per cent of all patients with cerebral palsy have normal mentality and that there are thus approximately 108 patients amenable to treatment in each 200,000 of the general population. Of these 108, 41 per cent are athetosic, 54 per cent spastic and 5 per cent ataxic. It was impossible to test the intelligence quotient of all our patients, and the aforementioned figures were arrived at after an evaluation of the history and a comparatively short period of observation, which handicaps us greatly when dealing with some of the entities of chronic disease.

After careful analysis of our original records and data subsequently received, we thought that we were definitely too critical in condemning the mental status of 20 patients and questionably so in condemning that of 17 others. As evidence of this, we found that several children who had been classified as mentally defective when first seen here were keeping up with their classes at school without extra effort. Two or three were leading their classes.

This only serves to emphasize the mistakes that may be made and the harm done by attempting to classify the borderline cases by tests that are based solely on motor activity. It is evident that the percentage of those who are mentally normal but who are suffering from retardation due to the physical handicap is apparently greater than the actual percentage of feeble-minded.

Speech. — In Brockway's series, only 15 per cent showed a defect of speech after the sixth year. We tried to evaluate the speech of all children more than 2 years of age and found defects in 57 per cent. It should be noticed that this figure approximates our figures for the group of mentally defective and mentally dull children. Carlson stated that about 15 per cent of patients with cerebral palsy have impairment of hearing sufficiently to interfere with development of their speech and with their education. Phelps[7] stated that from the economic standpoint speech is of first importance, use of the arms second and use of the legs third. However, speech is an intricate muscular process and its disturbance is closely linked with the general spastic condition so that one cannot hope for much improvement until the patient has gained control over the larger muscle groups. Then, too, much can be done by instructors trained in speech work. Marked improvement in school work and an increase in the intelligence quotient of 10 to 30 per cent have been observed in many instances after the defect of speech has been overcome.

Children who have cerebral palsy have irreparable damage to brain tis-

sue. Nevertheless, the developing cerebrum has tremendous powers of adaptation and substitution of intact portions for the parts damaged.[4] Phelps[7] has said that cortical control is analogous to the playing of automatic scales on a piano from repeated practice.

As has been said, the pyramidal tract syndrome is characterized by spasticity and impairment of voluntary movement. The flexors and abductors of the lower extremities are overpowered by the extensors and adductors, and the patient tends to walk on his toes with the legs in the adductor position. When the upper extremity is affected, the arm is held tightly to the side with the forearm pronated and the wrist and fingers flexed. Rigidity, tremor and athetosis are the outstanding features of the extrapyramidal tract syndrome, that is, when there is damage or destruction to the basal ganglions.

Treatment

Although the types of treatment for the two kinds of cerebral palsy differ from one another in some respects, there are certain basic factors which can be laid down for both. Phelps[7-9] stated these as: (1) development of simple motor coordination and balance (all patients should be given careful lessons in balance of the trunk, first when standing, then when kneeling and lastly when walking), (2) control of behavior and (3) the simplest control of psychologic reactions to situations. We therefore see that training must be interrelated between the fields of orthopedics, physical therapeutics, psychology, speech control and education.

Physical Therapy. — Repetitive methods of muscle training are of definite use for spasticity, but they are of no avail for athetosis, for which the basic principle in treatment is relaxation. Only by careful examination of muscles are the indications for the type of treatment established.

In cases of the pyramidal syndrome, voluntary exercises to strengthen the weak antagonists are of definite value. However, passive exercises should be avoided, as in them the aim of treatment is defeated by the stretch reflex. Substitution and adaptation of the intact cortex is encouraged early by simple active exercises, the skilled motions necessarily being postponed until late in the treatment.

In cases of the extrapyramidal syndrome, voluntary motion is present and the aim of treatment is to overcome the involuntary motion characterized by rigidity, tremor and athetosis. These disappear on relaxation and in sleep. Relaxation is consciously acquired or is induced by massage in a suitable environment. Then, as the involuntary motions are abolished, purposeful and coordinated motions are acquired.

Carlson[6-10-11] cited many striking examples to show the effects which such factors as fear, concentration, attention and self consciousness play in controlling or in increasing abnormal movements of posture.

For proper relaxation, a calm and quiet atmosphere is necessary. This atmosphere may be acquired in many different ways and must be adapted to the individual case. For details concerning this phase of the treatment the reader is referred to the articles by Carlson,[6-10-11] the book by Fischel,[12] which, as Phelps[7] pointed out, deals with treatment of the athetosic child, and the one by Girard,[13] which deals with the truly spastic one. Suffice it to say that a tremendous psychologic factor is involved and the results will depend not only on the skill and resourcefulness but on the personality and enthusiasm of those working with and managing the child.

The crux of the treatment, then, lies in helping the spastic child to forget himself. Herein lies the secret for both mental and physical de-

velopment. In contrast with treatment for anterior poliomyelitis, more attention and thought must be given to the sensory side of the reflex arc than to the motor side when one is dealing with spastic children. The spastic child must avoid too many sensory stimuli to which the nervous system has not yet been accustomed. As Carlson[10] so ably said, "A sound mind behind a crippled body will also become crippled unless we provide that mind with adequate channels for the reception and expression of ideas."

The function of physical therapy is to teach the fundamental motions of one joint. When the primary motions can be performed and grouped, occupational therapy should be brought into the picture. When the patient is old enough to determine the line in which he is to be trained, occupational therapy should give way to vocational training. This sequence of treatment can best be accomplished by stressing education of the part in which the patient is most interested.

Surgical Treatment. — There are numerous surgical procedures which may be indicated in the treatment of cerebral palsy. However, it is important to realize that each surgical procedure must be adapted to the individual case and for that reason these operations should be performed by a well trained orthopedic surgeon who has had experience in this field.

Of the various surgical procedures, the one most commonly indicated is that which lengthens the achilles tendon. Next comes the so-called Stöffel operation, most often performed for adductor spasm. For this condition, the operation is an obturator neurectomy, and often it is combined with adductor tenotomy. The other operations which may be indicated, depending on the individual case, are: (1) neurectomy to the gastrocnemius muscle, (2) tarsal arthrodesis, (3) transplantation and tenotomy of the pronator teres muscle, (4) arthrodesis of the wrist, (5) ramisection, (6) spinal fusion, and so forth, down the line to those which are now rarely performed for this condition.

Little can be accomplished by surgical procedures for athetosis. In fact, surgical procedures employed for such conditions oftentimes have resulted in the opposite deformity. Naturally one thinks that localized athetosis may be corrected by transplantation of muscles, but Phelps[7] has said that such is not the case because the athetosis is likely in most instances to shift to the transplanted group, which formerly may have shown no signs of athetosis. However, severe, comparatively localized athetosis may be reduced in some cases by myotomy.

In Brockway's series, 542 operations were performed in 1,000 cases. It is to be remembered, however, that his patients were in an institution and thus under constant and prolonged observation. Because of this, the response of the child to more conservative therapy could be evaluated and the age at which, or the time when, operation was indicated could be better determined. Usually, our patients were under observation for only three or four days. Naturally, this made it rather difficult for the orthopedic department to advise operative treatment, as it was hard to credit the benefits which would be derived. Consequently, of 171 patients, only 27 had an operation of any kind. Fourteen of these had the achilles tendon lengthened. Most of these 27 patients returned to the clinic for further observation and examination, and it was determined that 10 were definitely improved by operation whereas 8 were unimproved. There was no follow-up record obtainable on 9 patients.

When considering operation for a spastic child, it is important to remember that operation alone is not likely to benefit the patient and that it never will cure him. In the majority of cases operation has but one pur-

pose, and that is to overcome contractures. Proper physical therapy after operation is usually much more important than the operation itself.

Braces. — Some men, among them Brockway, feel that bracing is indicated in a large percentage of cases. We feel that braces are definitely contraindicated in most instances, and they are little used except after operative procedures. Braces only call the attention of an already sensitive child to his handicap. We know that the spasticity is still present, even though the extremity may be firmly immobilized. As long as a brace is worn there is little chance to train the antagonists of the spastic muscles.

Follow-Up Studies

A letter or questionnaire was sent to the 58 patients, or to their parents, for whom we outlined a regimen of physical therapy in the years 1936, 1937 and the first part of 1938. This was done in an attempt to determine the interest of the patient or the parents in the matter and the effect of physical therapy carried out in the home over a period of two to three years. Thirty-eight (65.5 per cent) of the questionnaires were answered (table). Twenty-

Results of Regular and Irregular Home Physical Therapy Treatments After an Observation Period of Two to Three Years in 38 Cases.

Types of Treatment	Degree of Improvement					Totals
	Dennite	Considerable	Moderate	Slight	None	
Regular physical therapy	4 (17.4%)	8 (34.8%)	5 (21.7%)	4 (17.4%)	2 (8.7%)	23
Irregular or no physical therapy	0	0	3 (20%)	6 (40%)	6 (40%)	15
Totals	4	8	8	10	8	38

three patients (60.5 per cent) have continued to carry out the regimen outlined here, on an average of one hour daily, six days a week. The remaining 39.5 per cent carried out the regimen irregularly or not at all. In an attempt to evaluate the degree of improvement, we considered this to be marked or outstanding if the patient is now able to approach in an appreciable measure the activities of the chronologic normal. As an example, one girl 4 years of age who was seen here two and a half years ago was unable to stand or sit without support. Now she not only is able to walk, but climbs a low ladder, skips a rope and skates on ice in a manner compatible with her age. From the peak of marked improvement we attempted to grade the patients down the line into the groups showing considerable, moderate, slight and no improvement. Table 1 demonstrates clearly the contrast of the degrees of improvement in the two groups of patients. It can be seen that 63 per cent of those receiving proper therapy showed marked, considerable or moderate improvement, whereas only 20 per cent of those receiving insufficient therapy experienced moderate improvement and none in this group showed marked or considerable improvement.

Although of the 38 patients from whom replies to our questionnaires were received, the majority showed only slight or moderate mental deficiency, if any, in every instance of appreciable physical improvement there was likewise mental improvement. Corresponding improvement in speech was also noticed.

Summary

In an attempt to evaluate the results of therapy as prescribed at the Mayo Clinic, we have studied 168 consecutive cases encountered in the years 1936 and 1937.

The distribution according to sex was about even; 55.6 per cent of the patients were males and 44.4 per cent were females. Treatment is started entirely too late in most instances. The laity and the medical profession should be informed of this fact. In more than 50 per cent of cases all extremities are involved to some degree, and therapy should be instituted with this in mind. The mental status of the patient is too readily condemned by some examiners. As the patient improves physically, improvement in mentality and speech can be expected.

Although treatment for the pyramidal syndrome differs from that for the extrapyramidal syndrome, there are certain basic principles that hold for both. There is a psychic factor which must be taken into account in all cases. Surgical procedures should be individualized in all instances. These are best performed by an orthopedic surgeon who has had considerable experience with cases of cerebral birth palsy. Operation has little to offer for the athetoid type. Proper physical therapy after operation may be more important than the operation per se. Braces are definitely contraindicated in most instances. The cooperation of the parents is essential.

One of the most important factors in the treatment of cerebral birth palsy is a proper regimen of continued physical therapy. If this is carried out faithfully over a period of years, appreciable improvement can be expected in at least 63 per cent of patients not too deficient mentally whereas only 20 per cent will show appreciable improvement if treatment is not carried out regularly.

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ARTIFICIAL FEVER AND VITAMIN THERAPY IN TREATMENT OF ANTERIOR POLIOMYELITIS *

Report on Intraspinal Administration of Thiamine Chloride Combined With Artificial Fever Therapy

SIMON STONE, M.D.

MANCHESTER, N. H.

Much interest in the therapy of anterior poliomyelitis has been aroused in this country since the introduction of the Kenny method of treatment for the peripheral manifestations in the early stages of this disease. The enthusiasm which frequently follows the application of new methods of treatment for any severe disorder has been manifested for the Kenny treatment. The results in a number of cases[1] so far seem to suggest that the Kenny method is preferable to total immobilization. The children treated by this method are reported to appear much more comfortable during the acute stage and to show fewer residual deformities.[2] The failure, however, by Miss Kenny and her followers to carry out more careful muscle analyses during the acute stage and the lack of accurate statistical evaluation of the end results from her treatment make it difficult to compare adequately the final results from the Kenny treatment with those obtained when other methods are used. The fact that the hot fomentations have no effect on the pathologic changes in the spinal cord leaves this method of treatment somewhat limited in its scope. Another shortcoming of the method is that it requires the constant services of several nurses and attendants during the painful period, which occasionally lasts a number of weeks, and thus proves a burden on the hospital staff. Also, Miss Kenny's disregard of the need for braces and other supports after the patients have reached the ambulatory stage will, in some instances, nullify the improvement obtained from the hot fomentations.

In a previous report[3] the results from the administration of artificial fever to 6 patients with anterior poliomyelitis seen in the acute stage were described. All the patients in this group received intravenous or intramuscular injections of thiamine hydrochloride while receiving the artificial fever treatments, together with oral doses of vitamin B complex and vitamin E in the form of wheat germ oil. Rapid disappearance of muscle pain, failure of fibrositis or contractures to develop after treatment and shortening of the period of convalescence were the outstanding results. Also, the patients appeared in much better general health than patients not similarly treated. The action of the artificial fever and the vitamins was considered of a nonspecific nature, the former producing an increase in blood supply in the spinal cord and indirectly increasing oxygenation of the affected nerve cells, besides relieving vasospasm and muscle spasm in paralyzed extremities, and the latter through its beneficial chemical effects on nerve cell metabolism. It was assumed that, while a number of neurons were completely destroyed by the virus, there remained some cells only partially affected, and that with increased oxygenation and improved cell metabolism some of these cells could be brought to function efficiently again. The greater need for thia-

* From the Neurological and Artificial Fever Therapy Services Hospital, Manchester, N. H., and the Crippled Children's Services of the State of New Hampshire.

* Dr. Ezra A. Jones, Medical Director of Crippled Children's Clinics of New Hampshire and his associates, Dr. Carl R. Friborg and Dr. R. R. Rix, have supervised the orthopedic treatment of these patients.

mine in cells partly affected by toxins or disease[4] and the better results previously observed in tabes dorsalis[5] when thiamine hydrochloride was administered intraspinally in combination with artificial fever therapy prompted the substitution of the intraspinal for the previously used intravenous or intramuscular route in cases of anterior poliomyelitis. Only patients with severe cord involvement and advanced paralysis of extremities were treated by this method. The patients in this group had been treated elsewhere immediately after the appearance of symptoms and were not seen for two to six weeks after the onset of the disease. They all continued, however, to display generalized muscle tenderness and rigidity of neck and back muscles besides the paralysis.

Method of Treatment

The combined atrificial fever-vitamin therapy in cases of anterior poliomyelitis was begun in 1939. At first the thiamine hydrochloride was administered intravenously or intramuscularly during the height of the fever. In 1941 the subarachnoid method of administration was substituted, with the drug introduced into the spinal canal eighteen to twenty-hour hours before the next artificial fever treatment. The following procedure was used: A spinal puncture was carried out with the patient under local procaine hydrochloride anesthesia, lying on one side. The initial spinal fluid pressure was determined, and the crystalline thiamine hydrochloride* was dissolved in 5 to 10 cc. of spinal fluid, a larger amount of spinal fluid having been used for patients with cervical cord involvement and a lesser amount for patients with involvement of the lower extremities. For children under 10 years of age 20 mg. of thiamine hydrochloride was used and for children over 10, 40 to 50 mg., with a maximum dose of 50 mg. in a single injection. Five to 7 cc. of spinal fluid was then removed for cytologic examination and chemical tests and the solution of thiamine gradually reinjected into the spinal canal, being freely mixed with fresh spinal fluid. This procedure was repeated about once every seven to ten days, eighteen to twenty-four hours before the next fever treatment. No unpleasant reactions and no discomfort were observed in any of the patients after the administration of the thiamine hydrochloride.

The artificial fever was administered by means of an inductopyrexia cabinet, usually on the day after the intraspinal medication. The patient's temperature was gradually raised to 104 or 105 F. and was maintained for one to two hours at a temperature over 104 F. Ascorbic acid in doses of 150 to 200 mg. was given to all patients while they were in the fever cabinet, together with fruit juices and saline solutions orally. The temperature at the range described was well tolerated by all the children. It was felt that the intraspinal thiamine administration increased the tolerance of these patients to the artificial fever treatments. Vitamin B complex, 4 to 8 cc. daily, together with wheat germ oil, 1 to 2 cc. daily, was administered in a mixture orally. None of the children were immobilized, and splints, if used, were applied primarily for support. Physical therapy in the form of passive movements was begun when it could be tolerated without discomfort, and active movements were started when all muscle pain disappeared. Muscle testing was carried out by a competent physical therapy technician after admission and at intervals during hospitalization in a manner that would not exhaust the affected muscles or aggravate the muscle tenderness but would provide a working idea of the muscles involved and the progress made. Frequent rechecks were made after the patient's discharge from the hospital, and physical therapy, including pool therapy, was carried out whenever facilities were available. All the children were under orthopedic supervision during their entire period of hospitalization, and no child was allowed to stand, walk or leave the hospital without proper support whenever it was indicated.

Patients Treated and Results

The 11 patients who received artificial fever or artificial fever combined with intraspinal thiamine therapy were children with anterior poliomyelitis seen through the Crippled Children's Services of the State of New Hampshire. While 63 patients with anterior poliomyelitis were seen during the period of 1940 to 1942, these children were the most severely affected ones. In almost all the other cases good results were obtained with rest during

* Thiamine hydrochloride in crystalline form—Betabion, Merck, or Betaxin, Winthrop, was used.

the acute stage, orthodox physical therapy and vitamin therapy. The children treated with artificial fever had extensive involvement of the musculature of one or more extremities, associated with generalized muscle pain and spasm and rigidity of the back and neck. The oldest patient was 17 and the youngest 2½. Three of the children had previously received hot fomentation treatments for periods ranging from two to six weeks, without relief from muscle tenderness and pain on motion or improvement in the state of paralysis. Six patients received artificial fever and vitamins B and E orally, and 5 patients received intraspinal injections of thiamine hydrochloride besides the artificial fever and oral vitamin therapy.

The paralyses in the children who received the combination of intraspinal thiamine therapy and fever therapy were as follows: Three children had bilateral involvement of lower extremities with no muscular action above a trace in one extremity. Another child had similar involvement of one extremity and fair to good function in another. The fifth patient had severe involvement of all the muscles in one upper extremity, with these muscles rating zero to a trace in strength, and considerable involvement of the opposite extremity. This patient continued to have severe discomfort and muscle spasm in these muscles after six weeks of hot fomentations. These children showed generalized tenderness, all passive movements were painful and they were unable to turn over without assistance, and in 2 even the slightest change in position produced exquisite pain.

The improvement in the general condition of these patients even after a single combined treatment was noticeable. This was manifested in reduction of muscle tenderness, in increase in range of passive movements as a result of relief from pain, so that bedside care could be administered with less discomfort, and improvement in general health. After several treatments they appeared stronger, were able to sit up without support, which they could not do formerly, and exhibited a greater range of movement because of freedom from pain. The skin of the affected extremities had lost its dry, mottled appearance, the color and temperature appeared normal and the extremities appeared alike although one was severely paralyzed. In muscles which were not completely paralyzed an increase in strength of one or two points, as from a trace to poor or to fair, was observed. None of the children developed any contractures. All joint movements could be carried out without discomfort, and no scoliosis or other deformities of the back, have been evident so far.

The average course consisted of four treatments, although 1 child received seven artificial fever treatments and four intraspinal injections. The hospitalization time was four months and nine days for the most severely affected child. This child displayed severe generalized tenderness on admission, three weeks after the onset, involving the neck, back, abdomen and muscles of the lower extremities. It is probable that if she had been placed under proper therapy earlier the hospitalization time would have been greatly reduced. Pool therapy and other physical therapy were administered to the children during their stay in the hospital. Oral vitamin therapy was continued at home, and muscle rechecks and orthopedic reexaminations were carried out when possible at monthly intervals. All the patients in this group became ambulatory, and the children of school age returned to school. The general health of the children has continued excellent since their discharge, and this probably was due to their improved nutritional status and increased vitamin intake. So far 2 of the children have required a single brace each, and it is probable that another child will

Summary of Cases Treated by Artificial Fever Combined with Vitamin Therapy

	Patient	Sex	Age, Yr.	Duration of Disease	Clinical Findings on Admission	Hospitalization Time	Treatment	Results from Treatment and Present Status
1.	L. S.	F	6	3 wks.	Total paralysis of right lower extremity with all muscles rating zero to trace; incomplete involvement of left lower, with muscles trace to fair; paralysis of abdominal and back muscles; generalized muscle tenderness, most severe in lower extremities, associated with dry, mottled, cold skin; all motions produced exquisite pain	4 mos. 9 days	7 Artificial fever treatments: 12/11/41 12/18/41 12/27/41 12/30/41 2/28/42 3/18/42 4/18/42 Intraspinal thiamine medication: 2/11/42—20 mg. 2/27/42—20 mg. 3/17/42—50 mg. 4/17/42—20 mg. Vitamins B and E orally	Disappearance of all tenderness following 4th treatment; improvement in physical status; normal left lower extremity; normal back and abdominal musculature; right lower extremity: muscle strength poor in thigh and hip muscles, and zero to trace in muscles of leg and foot; patient wears a brace; has returned to school
2.	R. D.	M	4	1 mo.	Total paralysis of right lower extremities; partial paralysis of left lower; severe pain on muscle movements in both extremities; weakness of abdominal and back muscles	3 mos. 8 days	5 Artificial fever treatments: 1/13/42 2/ 7/42 2/17/42 3/31/42 4/25/42 Intraspinal thiamine therapy: 2/ 5/42—12 mg. 2/16/42—20 mg. 3/30/42—20 mg. 4/24/42—50 mg. Vitamins B and E orally	Complete disappearance of muscle tenderness; normal range of joint movements; normal left lower extremity; right lower: all muscles functioning but only trace to poor in strength; patient is wearing a brace; up and around daily
3.	R. G.	M	17	1 mo., 12 days	Paralysis of muscles of both lower extremities with most muscles poor to fair; bladder involvement; tenderness of all muscles; dry, mottled skin	36 days	2 Artificial fever treatments: 10/27/42 12/ 2/42 Intraspinal thiamine therapy: 10/26/42—50 mg. 12/ 3/42—50 mg. Vitamins B and E orally	Disappearance of all muscle tenderness; generalized increase in strength; all muscles in left lower extremity rate normal; right lower: all muscles rate normal or good, except anterior and posterior tibials, which are poor to fair; no contractures; marked improvement in physical well-being
4.	P. C.	F	5	2 wks.	Weakness of left lower extremity; all muscles in right lower rate zero to a trace, a few fair; reduced strength of cervical, lower back and abdominal muscles; residual muscle tenderness.	40 days	4 Artificial fever treatments: 11/18/42 11/24/42 12/ 7/42 12/14/42 Intraspinal thiamine therapy: 11/17/42—20 mg. 11/23/42—20 mg. 12/26/42—20 mg. Vitamins B and E orally	Disappearance of all tenderness; no contractures; left lower extremity, all muscles rate normal; right lower extremity: improvement from 1 to 2 points, most muscles rate good or fair; patient required a brace for a time
5.	S. H.	M	14	34 days	Left upper extremity; all muscles of shoulder girdle rated zero to trace, trace to poor in arm and forearm, poor to fair in hand; right upper extremity: all muscles of shoulder girdle and arm rated fair, normal or good in forearm and hand; reduction in strength of lower extremities; exquisite tenderness of muscles of upper extremities on motion	1 mo.	4 Artificial fever treatments: 12/ 1/42 12/ 8/42 12/14/42 1/ 6/43 Intraspinal thiamine therapy: 11/30/42—50 mg. 12/ 7/42—40 mg. 1/ 5/42—40 mg. Vitamins B and E orally	Rapid improvement in well-being followed second treatment; disappearance of all muscle tenderness; right upper extremity normal; left, increase in strength from trace to poor and from poor to good; arm in sling; normal strength in lower extremities; returned to school
6.	T. D.	M	10	2 mos.	Extensive paralysis of muscles of left shoulder, arm, and forearm; paralysis of both deltoids; patient unable to open mouth widely; muscles tender and show evidence of fibrosis	36 days	18 hours of artificial fever in 9 treatments	Disappearance of all tenderness; patient able to open and close mouth well; general improvement in muscle strength; abduction of deltoids raised from 45 to 120 degrees
7.	P. L.	M	2½	3 days	Neck rigidity; bilateral Kernig; muscle tenderness; severe paralysis in both lower extremities with complete loss of function in left lower extremity	5 mos. 26 days	2 Artificial fever treatments: 20 mg. of thiamine intramuscularly with fever treatments Vitamins B and E orally	Complete recovery in right extremity; left lower: return to some power in hip, fair to good power in dorsiflexors of foot, fair power in invertors, evertors and plantar flexors, fair to good power in quadriceps, good power in biceps, fair power in semimembranosus; no contractures; no fibrosis; patient required brace for a time

(*Table concluded on next page.*)

Summary of Cases Treated by Artificial Fever Combined with Vitamin Therapy (Concluded)

	Patient	Sex	Age, Yr.	Duration of Disease	Clinical Findings on Admission	Hospitalization Time	Treatment	Results from Treatment and Present Status
8.	J. D.	M	6	3 days	Generalized marked muscular rigidity and muscular tenderness; total paralysis of right shoulder, arm, and forearm with muscle function rating zero to poor	3 mos., 10 days	5 Artificial fever treatments: 9/27/41 10/ 1/41 10/10/41 11/ 6/41 11/20/41 Thiamine intramuscularly with fever treatments Vitamins B and E orally	Disappearance of pain; increase in range of movements; deltoid function fair; function of other muscles fair to good; no fibrosis and no contractures
9.	E. W.	M	12	5 wks.	Severe muscle tenderness; generalized fibrosis; weakness of abdominals; atrophy of leg and thigh muscles; limitation of flexion of spine; shoulders: abductors and external rotators poor, all other muscles fair; hips: abductors of both hips and internal rotator of left hip poor to fair, all others fair to good; patient totally bedridden	52 days	4 Artificial fever treatments: 11/18/41 11/21/41 11/28/41 12/13/41 Vitamins B and E orally	Disappearance of fibrosis and tenderness on motion; striking improvement in general health; no residual muscle weakness; after six months patient does all farm chores; is normal child.
10.	B. P.	M	7	4 days	Rigidity of neck and spine; marked tenderness of all muscles; patient unable to raise head or flex spine; weakness of muscles of lower extremities, with muscle strength poor to fair	41 days	4 Artificial fever treatments: 12/23/41 12/27/41 12/31/41 1/ 3/42 Thiamine intramuscularly: 10 mg. with fever treatments Vitaimns B and E orally	Disappearance of all muscle tenderness; patient walks without support; good power in all muscle groups except evertors and invertors of left foot and evertors of right foot; 1/5/43, no evidence of residual involvement
11.	L. C.	F	2½	8 wks.	Early fibrosis; muscle tenderness; weakness of gastrocnemius, anterior tibial, dorsiflexors, and invertors of left foot; also flexors and extensors of toes; only fair power in right gastrocnemius and extensor of toes	42 days	2 Artificial fever treatments: 1/ 7/42 1/12/42 Thiamine intramuscularly: 10 mg. with fever treatments Vitamins B and E orally	Disappearance of fibrosis and muscle tenderness; patient greatly improved physically; increase in muscle strength from poor to good; 1/14/43, gait normal except for some pronation of feet

require a brace for a time. One child required a brace for a number of months but return of muscle strength made further wearing of the brace unnecessary. Thus, of twenty-two extremities severely affected, only three required braces. These 11 cases are summarized in the accompanying table.

Comment

In the past all methods of therapy in poliomyelitis were aimed at the peripheral manifestations of the disease. It was accepted that unless a specific remedy was discovered which would be beneficial before paralysis had developed, no treatment would be of much value in alleviating the disease in the spinal cord. Treatment, therefore, for the last quarter of a century consisted primarily of immobilization and complete rest during the acute stage aimed at strengthening the affected muscles; physical therapy, hydrotherapy and muscle reeducation after all tenderness had disappeared, and correction of any deformities which might develop later. The shortcomings of this method were that in some instances the affected extremities were immobilized in a fixed position for long periods by means of casts, and this tended to produce additional muscle atrophy and organization of subcutaneous and intramuscular edema into fibrous tissue and contributed in some instances to the development of contractures and deformities. This method has been criticized vigorously in the past by Feiss[6] and Toomey[7] and recently by Miss Kenny.

Artificial fever, however, when combined with intraspinal administration of thiamine is not limited in its effects to the peripheral changes but acts

on the spinal cord, in that it probably hastens regeneration of some of the nerve cells not completely destroyed by the virus. The observation of Mieklejohn, Passmore and Peters[8] on the presence of a defective breakdown of pyruvic acid in carbohydrate metabolism in nerve cells in animals deprived of vitamin B_1, as well as in cases of chloroform poisoning, partial asphyxia, or insulin overdosage,[9] brings up the possibility that in anterior poliomyelitis similar "biochemical lesions"[10] exist in nerve cells not completely destroyed by the virus. Odom and McEachern[11] have demonstrated that thiamine deficiency will frequently unmask quiescent brain lesions in experimental animals and that regression of these signs takes place after subarachnoid injections of thiamine hydrochloride. This would suggest a greater need for thiamine in a variety of pathologic states and would help explain the nonspecific beneficial effect of vitamin B_1 on nerve cells whose function is deranged, whether by toxins, poisons, trauma, actual vitamin deprivation or deprivation secondary to virus invasion. It is probable that the basic "biochemical lesion" in the cells whose internal milieu has been deranged is the same irrespective of its origin. The thiamine was administered in the cases of poliomyelitis for its nonspecific beneficial effect on nerve cell metabolism, and the intraspinal route was considered preferable because it places the thiamine in greatest concentration and in closest proximity to the affected cells in the spinal cord and affected nerve roots. The safety of the intraspinal route has been demonstrated,[12] and so far no unpleasant complications have been observed if usual aseptic precautions were followed and crystalline thiamine hydrochloride used. When it is administered twelve to eighteen hours before the next artificial fever treatment, better diffusion of the thiamine in the nervous system is assured. It was found that these patients tolerated the artificial fever therapy better, and this is not surprising in view of the findings of Mills[13] of greater requirements for thiamine with elevation of temperature.

The action of the artificial fever is also nonspecific.[14] It increases the rate of blood flow through the entire body, including the central nervous system; the oxygen saturation of the blood is augumented; improvement in cell metabolism is produced, and catabolic products are removed at a greater rate. It also acts directly on the peripheral manifestations of the disease by relieving vasospasm and muscle tenderness, improving local circulation and thus assisting in absorption of intracellular and extracellular edema and so probably indirectly prevents the organization of exudates. The artificial fever will accomplish all that is claimed for the hot fomentations, but its administration is simpler where facilities are available and its effects are not limited to muscular symptoms.

The addition of vitamin E was based on previous observations on its effect on muscle tone,[15] and capillary permeability[16] and on the beneficial results in the treatment of fibrositis[17] and in selected cases of muscle atrophy and dystrophy.[18] Vitamin B complex was used because of its supposed synergistic action with vitamin E.[18]

No discussion of therapy for anterior poliomyelitis can be considered complete unless it includes some consideration of the Kenny method. According to Miss Kenny[19] the cardinal symptoms of the disease are "muscle spasm," "muscle incoordination" and "mental alienation." Paralysis of muscles as a result of involvement of the cells in the spinal cord or elsewhere in the nervous system is considered by her to be a factor of less importance. The protagonists of Miss Kenny[20] consider the muscle changes in anterior poliomyelitis to be caused by the "spasm," far more damaging to the mus-

cular system if unrecognized and untreated (i. e., according to the Kenny method) than the paralysis caused by injury to nerve cells in the spinal cord. Miss Kenny[21] also claims that the muscles affected by the disease are the muscles in spasm and that the patient frequently loses power because the affected muscles (i. e., muscles in spasm)are pulling the nonaffected muscles (i. e., muscles which supposedly show the flaccid paralysis) from their normal resting place and thus retain them in the unrelaxed position. The spasm, she believes, is caused by direct pathologic change within the muscle, probably in the nature of an inflammatory process produced by the virus. This "spasm" if untreated by hot fomentations would continue till the muscle was reduced to a fibrous, inextensible mass. Before, however, Miss Kenny's contributions to the therapy of anterior poliomyelitis are analyzed, the Kenny method of hot fomentations for the relief of pain and spasm in the acute stage as a substitute for the total immobilization previously in vogue among orthopedic surgeons should be separated from the Kenny method of physical therapy, which is mainly a modification of the orthodox method with more stress laid on individual muscle function. There is no doubt that some muscle spasm and considerable pain are present during the acute stage. These are to a great extent relieved by the hot fomentations as described by Miss Kenny, by application of dry heat as used by Toomey,[7] by hot baths as used in 1916 by Lovett[22] and later by Ober[23] and even more rapidly by the use of artificial fever. Miss Kenny's assumption, however, that the muscle spasm in the acute stages of poliomyelitis is a result of direct pathologic changes produced in the muscles by the virus has not been proved as yet, and it is more probable that the muscle spasm and pain are due to involvement of the sympathetic peripheral ganglions and the sympathetic cells in the anterolateral horns of the spinal cord than that they are caused by inflammatory condition within the muscles. The disturbance in sympathetic function is also manifested in the cold, mottled extremities, disturbances of the sweating mechanism and the subcutaneous and intramuscular exudates so frequently seen in this condition. The pain is probably more in the nature of a causalgia, as described by Weir Mitchell.[24] The sympathetic origin of some types of peripheral pain has been stressed in the past by Leriche,[25] and a neurovascular origin for certain causalgia-like states has been suggested recently by Homans.[26] Whether the pain in anterior poliomyelitis is secondary to the neurovascular disturbances and concomitant vasomotor manifestations or is due to direct involvement of the sympathetic supply of muscle fibers, as described by Kure,[27] is undetermined. These vasomotor disturbances will remain permanent in some cases if left untreated, and this would account for residual changes in circulation of extremities observed years after the onset of the disease. The rigidity of the back and neck muscles is, however, probably more in the nature of a protective phenomenon to prevent extensive movement of inflamed spinal cord and nerve roots and is akin to the muscle spasm observed over a fractured bone. The rigidity usually becomes relieved spontaneously when the acute stage is over, whether treated with hot fomentations or left untreated.

The organization of the subcutaneous and intramuscular exudate as a result of disturbance of the internal metabolism of the muscles is no doubt one of the causes of the contractures and deformities occasionally seen in anterior poliomyelitis. This is, however, produced by vasomotor changes in the affected extremities and is not due to pathologic change within the muscle. The application of heat locally, from whatever origin, helps to relieve this vascular spasm, and its effects are similar to those produced by

sympathectomy.[28] Prolonged immobilization in a fixed position only aggravated this state of spasm, put an extra burden on an already defective local circulation and retarded the absorption of tissue exudates by limiting contraction of muscles whose function had not been totally destroyed by the disease. While Miss Kenny's criticism of this phase of therapy is fully justified, her statement[19] that "application of physical therapy in the past was for symptoms that did not exist and consequently the results could not have been satisfactory" is not based on adequate data. Miss Kenny has used some of the unsatisfactory results observed after prolonged immobilization for the purpose of condemning as harmful all physical therapy outside of the Kenny method of muscle training. The results with orthodox physical therapy intelligently applied, when combined with rest and splinting for support only, during the painful stage, have been reported to show as large a percentage of improvement as the Kenny treatment.[29] Unfortunately, the data on patients treated by the Kenny method are less satisfactory for statistical evaluation for several reasons. The number of patients treated in the United States is comparatively small, and the reports from Great Britain[30] do not indicate that Miss Kenny has proved her point as to the cure of anterior poliomyelitis by her method. Also, Miss Kenny's criteria as to what constitutes deformities differ from the orthopedic surgeon's viewpoint. When she claims that many of her patients have no deformities while showing flail extremities as residuals,[31] it is apparent that some of the patients treated by others whom she disparagingly describes as representing poor results would show a higher percentage of recovery if her own standards were used. Her dependence on impressions of the original status of the patient rather than on a thorough examination would also help to raise the number of her cures, for what appears at first to be marked involvement is in a number of patients due to irritation rather than to actual cell destruction, and the speedy recovery of such patients has in the past been a godsend to cultists. While Miss Kenny has no doubt contributed some worth while new points in muscle training—and no physical therapeutist worthy of her or his salt fails to utilize new data gained from personal experience in dealing with individual patients—physical therapy remains limited in its range of usefulness, if, as pointed out by McCarroll,[32] the damage to the anterior horn cells in the spinal cord is extensive. Probably it is not the hot fomentations alone, or the Kenny method of muscle reeducation, but the avoidance of prolonged immobilization and the intensity and duration of the treatment which frequently lasts months and years for patients under Miss Kenny's care, at a rather high cost per individual patient—that make the Kenny treatment more effective in some cases than methods used in the past.

With "muscle spasm," "muscle incoordination" and "mental alienation" make up the important triad supposedly discovered by Miss Kenny. By "muscle incoordination," according to the protagonists of Miss Kenny,[33] is meant the spreading of motor impulses intended for a certain muscle to other muscles or groups of muscles due to such conditions as pain on attempted motion of the involved muscle or inability of that muscle to perform its proper function. This also includes incoordination within the involved muscle itself "so that ineffective contraction is produced instead of a coordinated rhythmic contraction producing maximum motion at the insertion of the muscle." Both conditions have been known in the past; the former was called muscle substitution[31] and the latter was described in 1916 by Lovett,[34] who pointed out that frequently only part of a muscle becomes paralyzed and as a result incomplete contraction takes place. Occasionally such failure of a muscle

to contract is actually caused by a fat deposit within the belly of the muscle, so that the contraction wave is not transmitted to the tendon, and this has been treated surgically with some success by Hipps.[35] The term "muscle incoordination" is, however, much less satisfactory, for it implies posterior column changes or cerebellar involvement, and both of these are notably absent in anterior poliomyelitis. The former terms of muscle substitution and partial contraction of muscle appear to be just as satisfactory and probably more descriptive.

"Mental alienation" is the term used by Miss Kenny to describe a condition in which there is inability to produce a voluntary, purposeful movement in a muscle in spite of the fact that the nerve paths to the muscle are intact. This, she believes, "is a physiologic block which must be distinguished from the organic interruption resulting from the destruction of the anterior horn cells by the disease." The term "mental alienation" describes a condition which is frequently seen in hysteria, when a patient forgets how to use a group of muscles or an extremity as a result of psychic factors, but is rather uncommon in anterior poliomyelitis, at least as a cause of permanent disability. When present in anterior poliomyelitis it is usually observed after attempts at excessive manipulation during the painful stage. Negative conditioned reflexes are established with a block between the cortex and end plates of the nerves in the muscle. I have seen it develop in several cases of Volkmann's contracture and in atrophic arthritis after injudicious manipulation while the patient was in severe pain. The patient, thus, apparently is unable to carry out certain movements. Reeducation, with whatever method is used, usually results in improvement, especially if gentle physical therapy is combined with intelligent psychotherapy. The term "negative conditioning," in the sense used by Pavlov,[36] would be more physiologically descriptive of this rather uncommon complication. The underlying mechanisms have been understood in the past although not described under the term "mental alienation," and any intelligent physical therapeutist, occasionally with psychiatric assistance, could handle it satisfactorily on the rare occasions when it did occur. Miss Kenny's innate ability as an empiric psychologist probably makes her more adept at dealing with such cases.

While one disagrees with Miss Kenny on her terminology and underlying pathology and her disparaging attitude toward physical therapy in the treatment of anterior poliomyelitis as practiced in the past, the fact remains that she has made an excellent contribution in that she focused attention on the danger of prolonged immobilization of affected extremities in a fixed position and suggested a simple method for the relief of the painful symptoms in the acute stage, the use of hot fomentations. While the Kenny method has some valuable points, its importance as a major contribution to the therapy of anterior poliomyelitis will require further substantiation. Eventually some of the worth while factors in the Kenny system of physical therapy will become incorporated into the standard methods hitherto followed, as suggested by Steindler.[37] This, however, will take place only after an impartial analysis of the end results in the Kenny-treated patients has been made and these results have been compared with results obtained with other methods, such as Toomey's[7] use of dry heat and electrotherapy, hot baths, and artificial fever combined with vitamin therapy. The danger of the Kenny treatment is that it will become a cult, and this will tend to impede rather than accelerate progress. After all, the better results reported originally from immobilization as compared with other methods of therapy

in vogue at that time were due primarily to the prolonged rest the patients were given, as opposed to the resumption of locomotion immediately after disappearance of acute pain, which had been the usual practice. Total immobilization, in a fixed position for a long period, finally became the accepted method of treatment in every case, irrespective of the extent and severity of the paralysis, especially after it had received the unqualified approval of the Harvard Infantile Paralysis Commission. The shortcomings of this unphysiologic method of therapy were sharply criticized, without much success, by Feiss[6] in 1922. There is a similar danger in the uncritical acceptance of the Kenny theories as to the causation of anterior poliomyelitis; and while her system of treatment has many excellent points, its unqualified acceptance by the medical profession will be apt to act as a deterrent to further progress in the therapy of this disease.

While the number of patients treated with combined vitamin-artificial fever therapy is comparatively small, the result so far would suggest that it will accomplish all that is claimed for the Kenny hot fomentations, besides possibly bringing back some neurons not completely destroyed by the virus. The disadvantages are that it cannot be administered unless facilities for artificial fever therapy are available, although the vitamin therapy is of definite value even without the fever. It requires, however, fewer personnel; fewer treatments are needed to produce alleviation of symptoms, and the relief is more rapid. The hospitalization time is also greatly reduced as compared with that needed for the Kenny treatment. In the absence of facilities for artificial fever, hot fomentations would be preferable to total immobilization, as they no doubt give more rapid relief from the pain and discomfort. Vitamin therapy also should be continued, together with the hot fomentation, for a considerable period after the acute stage has passed, because of its nonspecific effects on the nervous and muscular systems.

Although the protagonists of Miss Kenny's method claim that physical therapy as used in the past was for symptoms that did not exist, as applied in our cases in the forms of mild massage after all pain had subsided, muscle training and pool exercises, it was found an excellent adjuvant in maintaining muscle tone and gradually bringing back muscles whose nerve supply had not been completely destroyed. If the paralysis is complete, or very severe, little recovery is to be expected no matter what method is used. In some of our patients, however, who could be seen only at rare intervals because of inaccessibility, considerable spontaneous recovery took place without special physical therapy, especially if some muscular contractility was retained. These patients seemed to do better with additional vitamin therapy. This tendency to spontaneous improvement lends support to the observation of McCarroll[32] that considerable recovery resulted in anterior poliomyelitis without special treatment provided the muscles were treated gently and extra exertion avoided during the first two years after the attack.

The combined intraspinal thiamine-artificial fever method has been applied in the treatment of other myelopathies with promising results. This would again suggest a nonspecific beneficial effect on the "biochemical lesions" in cells in the nervous system whose function has been greatly impaired but not totally destroyed by infection or trauma.

Summary and Conclusions

1. Eleven patients with severe anterior poliomyelitis have received artificial fever treatments during the acute stage of the disease together with parenteral and oral vitamin therapy. Six of these patients received intramuscular or intravenous injections of thiamine hydrochloride and vitamins

B and E orally. Five patients received the thiamine intraspinally in doses of 20 to 50 mg., eighteen to twenty-four hours before the next artificial fever treatment.

2. The oldest patient was 17 and the youngest 2½ years. All the children had complete paralysis of one or more extremities, associated with generalized tenderness and pain on motion. Four to ten fever treatments were administered to each patient with a temperature range of 103 to 105 F.

3. The artificial fever was well tolerated by all the patients. Relief of pain and spasm, improvement in circulation and texture of the skin of the affected extremities, prevention of contractures and improvement in strength of the affected muscles were the outstanding results from the combined treatment. All the children have continued in excellent health since the completion of the treatment and have shown no evidence of fibrosis or limitation of joint motions. The hospitalization time was greatly reduced in all cases.

4. It is suggested that combined vitamin-artificial fever therapy has all the advantages of the hot fomentation treatment, besides favorably influencing regeneration of some neurons not completely destroyed by the virus. The action is probably nonspecific and is due to improvement in cell metabolism and relief of local vasospasm in affected extremities. While the number of patients treated so far is comparatively small, the results in those treated in the acute stage suggested that this method is superor to methods used in the past. Its application to other types of paralysis of spinal origin has given promising results.

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MEDICAL NEWS

Pennsylvania Academy of Physical Medicine Holds Meeting

A panel discussion on peripheral vascular disease was conducted by *Joseph C. Doane*, M.D.; *Norman S. Rothschild*, M.D., and *Frank Follweiler*, M.D., at the regular meeting of the Pennsylvania Academy of Physical Medicine. The session was held at the Jewish Hospital, Philadelphia, May 20, 1943.

Midwestern Sectional Meeting

The ideal facilities and the graciousness of our member hosts Dr. Frank H. Krusen and Dr. Earl C. Elkins contributed to the splendid meeting which was the annual spring session of the Midwestern Section of the Congress held in Rochester, May 28 and 29. The program as discussed in detail in the May issue of the ARCHIVES was carried on during day and evening sessions. The scientific and clinical aspects of physical therapy were ably as well as impressively presented by prominent guest and member speakers. The papers were certainly thought provoking and created much lively discussion. Many of them will appear in subsequent issues of the ARCHIVES. The beautiful setting of the Mayo Foundation House, the old home of the late Dr. W. J. Mayo will not soon be forgotten by those who were privileged to enjoy its delightful surroundings. The officers of the section, Dr. Wm. Paul and Dr. Max Newman, deserve much credit for their part in this successful meeting.

Hospital Infantil de México

This hospital is described in a well illustrated paper booklet just received. Dr. Nicandro Chávez is in charge of the Department of Physical Therapy. The part describing this department has been translated as follows:

Physical Therapy will be a new and great department at the service of nurses for treatment of children with permanent defects which obviates the use of their hands, feet or any other part of their body, leaving them in the class of crippled children and therefore, making them inferior souls and a social and home charge.

The defects in their bones, articulation, muscles or any other organic tissues that the children might suffer at birth or that they might acquire by accident, will be corrected in this department.

The system of rehabilitation and reeducation of the lost functions by the organism, will be absolutely modern and guided by scientific technic and coordination with the clinic. To satisfy these wants, we can count on apparatus of reeducative gymnasium, electric systems and massage, teaching and practice of manual activities which not only correct the defects, but prepare the crippled children to help themselves in the social world, removing them from the danger of being helpless for life; the Department of Physical Therapy employs an excellent tank of luke-warm water which is filtered and purified where they exercise all the muscle movements and paralyzed articulations and where, following special systems our physical therapy technic will obtain the best results.

The specialized direction of the physicians who will manage this department, will assure the public and the medical profession of certain therapeutic results.

This department as well as the laboratories and x-rays, will be at the service, not only of the hospitalized children, but of all those who may be sent by family physicians.

New Dean at Oregon Medical School

Dr. David W. E. Baird, Jr., acting dean, has been appointed dean of the University of Oregon Medical School, Portland, to succeed Dr. Richard B. Dillehunt, who resigned. Dr. Dillehunt, who graduated at Rush Medical College in 1910, has been associated with the Oregon faculty since 1912, first as professor of anatomy and assistant dean and later as clinical professor of orthopedic surgery and head of the department. He had been dean since 1920.

National Foundation News

New Trustees Added

Basil O'Connor, President of The National Foundation for Infantile Paralysis, has announced the addition of nine members to the Board of Trustees of that Foundation, making the total number of Trustees thirty-nine.

Mr. Edsel Ford, one of the Trustees of the National Foundation, died recently in Detroit and his place has been filled by one of his sons, Lieutenant Henry Ford II.

The other eight new trustees come from Boston, Milwaukee, Pittsburgh and New York, and are: Benjamin F. Fairless, President, United States Steel Corporation, Pittsburgh, Pa.; Edward S. French, President, Boston and Maine Railroad, Boston, Mass.; Walter S. Gifford, President, American Telephone and Telegraph Company, New York City; Clarence G. Michalis, Chairman of the Board, Seamen's Bank, New York City; Bayard F. Pope, Chairman of the Board, Marine Midland Corporation, New York City; David Sarnoff, President, Radio Corporation of America, New York City; Juan T. Trippe, President, Pan American Airways, New York City; and Joseph E. Uihlein, Sr., Vice-President, Joseph Schlitz Brewing Company, Milwaukee, Wisconsin.

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ARCHIVES of PHYSICAL THERAPY

OFFICIAL PUBLICATION AMERICAN CONGRESS OF PHYSICAL THERAPY

.·. EDITORIALS .·.

WAR-TIME GRADUATE MEDICAL MEETINGS

After a study of methods whereby medical authorities might be utilized further in an educational program for the benefit of physicians in the armed services as well as civilian physicians, officials of the American Medical Association, the American College of Surgeons and the American College of Physicians, after conferring with Surgeons General James C. Magee, Ross T. McIntire and Thomas Parran, have appointed a committee to proceed with the development of War-Time Graduate Medical Meetings.

This program will be essentially an elaboration of a teaching plan that was used successfully in the Boston, Chicago and Philadelphia areas and was originated by the American College of Physicians. The program was so successful in a limited way that many requests have been received for its presentation on a national scale. In no way are the proposed courses to displace any of the educational activities now being carried on by the officials of the army and navy medical services.

For organizational purposes the country has been divided into twenty-four regions and a key committee of three men has been appointed in each region to carry on the details of the program. Likewise, to insure a worth-while program, a group of qualified authorities has been designated to serve as National Consultants in the various special fields. Twenty-four special fields of medicine are represented by National Consultants and one of the special fields is physical therapy. A National Faculty in physical therapy has been selected tentatively and if additional speakers are needed, this faculty will be enlarged.

The proposed National Faculty in physical therapy is as follows:

National Consultant: Dr. Frank H. Krusen

Regional instructors

Region 1. — Maine, New Hampshire, Vermont, Massachusetts
Dr. Arthur Watkins
Massachusetts General Hospital
Boston, Massachusetts

Region 2. — Connecticut, Rhode Island
Dr. Richard Kovács
2 East 88th Street
New York, New York

Region 3. — New York
Dr. K. G. Hansson
33 East 61st Street
New York, New York

Region 4. — Eastern Pennsylvania, Delaware, New Jersey
Dr. William Schmidt
Jefferson Hospital
Tenth and Walnut Streets
Philadelphia, Pennsylvania

Region 5. — Maryland, District of Columbia, Virginia, West Virginia
Lt. Glenn Drewyer
Naval Operating Base Hospital
Norfolk, Virginia

Region 6. — North Carolina, South Carolina
Maj. Earl Rothermel
Moore General Hospital
Swannanoa, North Carolina

Capt. Victor Pellicano
Station Hospital
Fort Bragg, North Carolina

Region 7. — Georgia, Florida
Dr. Robert Bennett
Georgia Warm Springs Foundation
Warm Springs, Georgia

Region 8. — Western Pennsylvania, Ohio
Dr. Walter Zeiter
Cleveland Clinic
Cleveland, Ohio

Region 9. — Michigan
Capt. D. W. McCormick
Station Hospital
Fort Custer, Michigan

Region 10. — Kentucky, Tennessee
Lt. Ray Piaskoski
Nichols General Hospital
Louisville, Kentucky

Region 11. — Alabama, Mississippi
Lt. E. K. Stucky
Station Hospital
Camp Shelby, Mississippi

Region 12. — Louisiana
Lt. G. G. Gill
La Garde General Hospital
New Orleans, Louisiana

Region 13. — Texas
Capt. J. R. Scales
McCloskey General Hospital
Temple, Texas

Region 14. — Indiana, Illinois, Wisconsin
Dr. John S. Coulter
Northwestern University Medical School
303 East Chicago Avenue
Chicago, Illinois

Region 15. — Minnesota, Iowa
Dr. Earl C. Elkins
Mayo Clinic
Rochester, Minnesota

Dr. Miland E. Knapp
Department of Physical Therapy
University of Minnesota
Minneapolis, Minnesota

Region 16. — Missouri, Kansas, Arkansas, Oklahoma
Dr. Frank Ewerhardt
Barnes Hospital
Washington University
St. Louis, Missouri

Region 17. — North Dakota, South Dakota, Nebraska
Dr. Earl C. Elkins
Mayo Clinic
Rochester, Minnesota

Dr. Miland E. Knapp
Department of Physical Therapy
University of Minnesota
Minneapolis, Minnesota

Region 18. — Montana, Wyoming
Maj. O. L. Huddleston
Department of Physical Therapy
Fitzsimons General Hospital
Denver, Colorado

Capt. John Naugle
Department of Physical Therapy
Fitzsimons General Hospital
Denver, Colorado

Region 19. — Colorado, Utah
Maj. O. L. Huddleston
Department of Physical Therapy
Fitzsimons General Hospital
Denver, Colorado

Capt. John Naugle
Department of Physical Therapy
Fitzsimons General Hospital
Denver, Colorado

Region 20. — New Mexico, Arizona
Capt. A. P. Martini
Beaumont General Hospital
El Paso, Texas

Lt. L. J. Kopf
Station Hospital
Davis-Monthan Field
Tucson, Arizona

Region 21. — Washington
Lt. Herman Rudolph
Baxter General Hospital
Spokane, Washington

Region 22. — Idaho, Oregon
Dr. William Northway
Stanford University Medical School
San Francisco, California

Lt. Howard Fralick
U. S. Naval Hospital
Oakland, California

Region 23. — Nevada, Northern California
Dr. William Northway
Stanford University Medical School
San Francisco, California

Lt. Howard Fralick
U. S. Naval Hospital
Oakland, California

Region 24. — Southern California
Dr. John S. Hibben
Medical Arts Building
201 North El Molino
Pasadena, California

Lt. Comdr. Frederick Lowe
U. S. Naval Hospital
San Diego, California

It has been arranged with the Council on Physical Therapy of the American Medical Association to prepare three sets of lantern slides which can be used in conjunction with the proposed specimen six-hour course in physical therapy. This specimen course is as follows:

Introduction (1 hour)

Definition, orientation, history, development since last year. Relationship to general medicine, surgery and other medical specialties, especially relationship to military medicine. Discussion of present needs for adequately trained physicians and technicians. Training program in progress. Place of physical medicine in medical practice. Variety of clinical material referred for treatment. Approximate percentage of patients treated. Discussion of increased demand for physical treatment in military practice.

Organization of a department of physical therapy. Personnel, medical and technical; stress need for trained personnel. Relationship of the department of physical therapy to the hospital as a whole. Relationship of physical medicine to the rehabilitation program. Discuss the probable developments in the program for rehabilitation of those injured in war.

Physical Agents Commonly Employed in Medical Practice (3 hours)

A. Thermotherapy

1. Local heat: sources, methods of application, lamps, baker and nonelectric types of heaters.
   Physiologic effects.
2. General applications of heat (fever therapy): methods of application, types of apparatus, technic, dangers, clinical applications.
3. Cold: sources, physiologic effects, possible indications in military surgery.

B. Electrotherapy

Fundamentals of electrophysics, types of currents employed in medicine. Galvanic or constant current: application in testing for reaction of degeneration, for muscle stimulation and for iontophoresis. Faradic current (tetanizing) as applied in diagnosis for reaction of degeneration and for muscle stimulation. Diathermy, elementary physics, terminology, types, methods of application, medical diathermy and surgical diathermy.

C. Light therapy

Physics, sources, clinical application of ultraviolet radiation in general.

D. Hydrotherapy

Methods, devices, whirlpool baths, contrast baths, tanks, pools, sprays, douches and packs.

E. Kinesitherapy

1. Massage: general considerations, movements, physiologic effects, indications.
2. Therapeutic exercise: physiologic effects, types of exercises, rules of exercise, indications.
3. Mechanical apparatus: corrective exercise apparatus and occupational therapy devices such as stationary bicycles, jig-saws, looms, shoulder wheels, Kanavel tables, suction pressure devices for circulatory diseases, and so forth.

F. Summary

Clinical Applications of Physical Agents With Special Reference to Military Medicine (2 hours)

A. Orthopedic conditions

Physical treatment of fractures, sprains, dislocations, foot disabilities, backache and postoperative lesions, especially amputation stumps and stiff joints. Also discuss physical therapeutic measures for the late treatment of burns and burn contractures and physical treatment following plastic repairs.

B. Physical therapy in relation to internal medicine

Physical treatment of peripheral vascular disease, dermatologic lesions, arthritis and metabolic disorders. Also discuss the physical treatment of immersion foot.

C. Physical therapy in relation to neurology

Physical treatment of peripheral nerve injuries and injuries of the central nervous system, head and spinal cord.

D. Physical therapy in relation to venereal diseases

Physical treatment of venereal disease, especially fever therapy for sulfonamide resistant gonorrhea, fever therapy in syphilis.

E. Summary and conclusions with regard to the relationship of physical therapy to military medicine.

NOTE: It is recommended that during presentation of courses in physical therapy, the "Manual on Physical Therapy," a thirty-five page booklet prepared by the Council on Physical Therapy of the American Medical Association and

the Subcommittee on Physical Therapy of the National Research Council and obtainable from Mr. Howard A. Carter, Secretary of the Council on Physical Therapy of the American Medical Association at 535 North Dearborn Street, Chicago, Illinois, be distributed to all listeners.

This booklet has been prepared for free distribution to regular officers of the Army and Navy Medical Corps.

It is also recommended that lantern slides showing the various physical devices and procedures be employed extensively in the lectures on physical therapy.

It is hoped that the various regional committees and commanding officers of army and navy hospitals will avail themselves of the opportunity to obtain lectures in physical therapy from this National Faculty. If plans develop satisfactorily, there will be a splendid opportunity for the advancement of physical therapy by dissemination of suitable information concerning it through the medium of these courses. If physical therapy is properly understood and practiced in our military hospitals, it should make another enormous stride forward. The machine is ready to go into operation. Let us hope that it will be utilized very fully.

FRANK H. KRUSEN.

SUNLIGHT CARCINOMA AND OTHER TUMORS INDUCED BY ULTRAVIOLET RADIATION *

Tumors of the skin of exposed parts of the human body in most cases are epidermal carcinoma, mostly of the squamous variety. Clinical observations and statistical study support the view that the most important cause of this carcinoma is sunlight, specifically the ultraviolet rays of the spectrum. For instance, more carcinoma of the exposed skin of white men occurs in the southern than in the other parts of this country. Farmers, sailors and other outdoor workers are more frequently victims of such carcinoma than persons less exposed to sunlight. Experiments have shown, moreover, that cancer of the skin as well as of other tissues is easily induced in albino mice and other animals by ultraviolet radiation under well controlled conditions. It has been found by Blum and his co-workers[1] at the National Cancer Institute that in mice ultraviolet radiation penetrates the skin to some depth and thus can act on a variety of cells, inducing different kinds of tumors.

The most recent analysis of the results of extensive experiments by Blum and his associates[2] showed that spindle cell sarcoma predominated while squamous carcinoma formed a smaller group often combined with sarcoma. Also hemangioendothelioma, osteochondrosarcoma, sebaceous carcinoma and even tumors of the eye developed in mice exposed to ultraviolet radiation, indicating that ultraviolet rays can induce tumors in various tissues depending on their susceptibility to its action and limited by the penetration of the rays. It would seem, then, that ultraviolet radiation can induce tumors in any susceptible tissue it may reach.

Why do not other forms of tumor besides epidermal carcinoma develop frequently in men freely exposed to sunlight? The reason appears to be that in man the amount of radiation reaching the dermis at best is not sufficient to induce the growth of tumors—sarcoma, and so on—of cellular elements in the dermal tissue. The workers at the National Cancer Institute found that the transmission of carcinogenic wavelengths by the human epidermis is much lower than by the mouse epidermis. In fact, in well tanned human skin almost no rays could reach the dermis. That white persons, especially blonds, seem more susceptible than Negroes to carcinoma of the exposed skin suggests that the pigment in the epidermis protects against the carcinogenic effect of ultraviolet rays.

References

1. Blum, H. F., and Lippincott, S. W.: Carcinogenic Effectiveness of Ultraviolet Radiation of Wavelength 2,537A, J. Nat. Cancer Inst. **3**:211 (Oct.) 1942. Kirby-Smith, J. S.; Blum, H. F., and Grady, H. G.: Penetration of Ultraviolet Radiation Into Skin as a Factor in Carcinogenesis, ibid. **2**:403 (April) 1942.

2. Grady, H. G.; Blum, H. F., and Kirby-Smith, J. S.: Types of Tumor Induced by Ultraviolet Radiation and Factors Influencing Their Relative Incidence, J. Nat. Cancer Int. **3**:371, 1943.

* Reprinted with permission, J. A. M. A. **121**:1285 (April 17) 1943.

Medical News

(*Continued from page 362*)

Back From Argentina

Dr. Rutherford L. John, of Philadelphia, one of the three experts in the Kenny method of treatment sent recently to Argentina by the Foundation to help fight an outbreak of polio there, returned to the United States this month. His co-workers, Mary Stewart Kenny and Nurse Ethel Gardner, of Minneapolis, are expected here soon.

A recent dispatch to the *Philadelphia Evening Bulletin* said that the mission had accomplished a great deal in promoting good will for the United States in Latin America. U. S. Ambassador Norman Armour was quoted as telling Dr. John: "Your visit has done more to build good will than a dozen movie stars, loans or other gestures."

The trio was royally received at the Argentine capital and had the full cooperation of the National Department of Hygiene and of the Asistencia Publica, municipal public health organization. Because there was not sufficient time for them to go far from Buenos Aires, delegations of nurses and doctors from the interior provinces and from across the Rio de la Plata in Uruguay came to watch them demonstrate the Kenny technic.

One incident of the trip illustrated the frequent necessity for ingenuity in helping treat infantile paralysis sufferers. At one hospital in Buenos Aires, sufficient hot water could not be obtained for the hot packs. Dr. John solved the problem. The "boys" at a flourishing American Legion post there were consulted. They got the representative of a pants-pressing company on the job. He ripped out a couple of boilers from the plant and had them set up. Within an hour another paralysis victim was being aided on the road to recovery.

But even more important than aid rendered to cases is the fact that the Americans' visit will probably result in Latin American countries sending medical men and women to the United States to study the treatment of poliomyelitis and who, after completing such training, will return and teach the method in their own countries.

Bibliography Project

A project which will make The National Foundation for Infantile Paralysis the only complete central, authentic source of information on Infantile Paralysis in the world was announced by Basil O'Connor, President of the Foundation.

A complete bibliography of all scientific literature that ever has been published pertaining to infantile paralysis is being compiled by the Foundation, and is expected to be ready for publication in book form in the early part of 1944. The first volume will contain a record of all scientific material on poliomyelitis published in the world up to the end of 1943. Subsequently, the data will be kept up to date by publication of annual supplements. Brief abstracts of the more important articles will be included in the bibliography to be published by the Foundation.

"This will be the first time there has been compiled a complete international bibliography on infantile paralysis," Mr. O'Connor said. "It will make available to the medical world data that will acquaint research workers with investigative work that already has been done in connection with the many aspects of the disease and be of great assistance in helping them avoid repetitious investigations.

"The collection of these data will make available for medical men throughout the world complete information pertaining to infantile paralysis articles published in any language. It will make instantly available to those who request it data never before gathered in one central location."

The compilation of the information is being carried out for the Foundation with the aid of the library of the American Medical Association and the John Crerar Library, both in Chicago, under the direction of Morris Fishbein, M.D., editor of *The Journal of the American Medical Association*, and Dr. Ludwig Hektoen, Chicago, editor of the *Archives of Pathology*.

Through the work of the International Committee for the Study of Infantile Paralysis, organized by Jeremiah Milbank in 1928, much time has been saved in the compilation of the early literature in the field of infantile paralysis. The committee, prior to its dissolution in 1932, had collected data pertaining to all literature regarding the disease that had been published up to that time. These data, now the property of the Library of the New York Academy of Medicine, have been turned over to the National Foundation for inclusion in the publication. Assisting in carrying out the work in Chicago is Miss Ella Salmonsen, medical librarian of the John Crerar Library.

Long-Range Training Program

The National Foundation for Infantile Paralysis and the University of Michigan have joined in a long-range program for the training of doctors, public health workers and laboratory technicians to study infantile paralysis and other virus diseases, it was announced today in a joint statement by Basil O'Connor, President of the Foundation, and Dr. Alexander G. Ruthven, President of the University.

This program, which has been developing for three years, will be expanded to its full scope when the University opens its new three-story building for its School of Public Health at Ann Arbor, Mich.

The new structure will house a unit devoted entirely to work in virus diseases, particularly infantile paralysis. The virologists who will be trained under the program will be prepared to attack the whole realm of virus diseases, including not only infantile paralysis but also influenza, atypical pneumonias, St. Louis and equine en-

cephalitis, measles, chicken-pox, smallpox and mumps.

To aid in the necessary planning and execution of such a project, the National Foundation now has made a three-year grant, totaling $120,000, to the University, Mr. O'Connor announced. This is in addition to three previous grants, totaling $110,000, made in the past three years, he added.

This makes a total of $230,000 which the Foundation has made available to the University of Michigan School of Public Health since May 13, 1940, when the first steps in this far-seeing program were planned by Mr. O'Connor and Dr. Henry F. Vaughan, dean of the School of Public Health.

Dr. Ruthven pointed out that, even though the school has not had adequate facilities during the two years since it opened, it has made several outstanding contributions to our knowledge of how polio is transmitted and on epidemic diseases in the army and in vital war industries. In addition, 20 men and women have received training in virology during that time.

"But it is extremely difficult to secure adequate and competent personnel without the assurance of financial support which extends beyond the period of twelve months," Dr. Ruthven said. "There are too many other opportunities offering tenure of position.

"This new three-year grant will insure the uninterrupted conduct of of this program for better national health," Dr. Ruthven stated.

This is the first time in the history of the National Foundation that three long-term grants have been made within the space of a single year, Mr. O'Connor said. Last month a five-year grant, totaling $150,000, was made to Yale University to permit it to reorganize its work on infantile paralysis and establish the Yale Poliomyelitis Study Unit. Last summer a five-year grant, totaling $300,000, was made to The Johns Hopkins University, at Baltimore, to establish and conduct the Center for the Study of Infantile Paralysis and Related Virus Diseases.

Meeting of Military Surgeons

The association of Military Surgeons of the United States will hold its 51st annual convention in Philadelphia at the Bellevue-Stratford Hotel, October 21-23, inclusive, according to an announcement by association officers.

The three-day convention will assemble doctors from all the current war fronts where United States forces are fighting, and from the great base hospitals where rehabilitation of the wounded is in progress. They will bring with them information on the latest technics of wartime medicine and surgery. Numerous forum lectures, practical demonstrations, moving pictures and teaching panels are planned to present the wealth of data to the convention.

Honorary chairman of the convention this year is Rear Admiral Ross T. McIntire, Surgeon General of the Navy. The general chairman is Captain Joseph A. Biello, Medical Corps, U. S. N., who is District Medical Officer of the Fourth Naval District.

The Vice-Chairmen are Brigadier General George F. Lull, U. S. A., of Washington, D. C., and Commander E. L. Bortz, Medical Corps, U. S. N. R., of Philadelphia. Members of the executive committee for the convention include Captain R. H. Laning, Medical Corps, U. S. N.; Dr. Stanley P. Reimann, Dr. Gilson Colby Engle, Commander J. L. Tinney, U. S. N. R., and Dr. A. Newton Richards.

National officers of the association are as follows:

President, Captain William L. Mann, Medical Corps, U. S. N., National Naval Medical Center, Bethesda, Md.; First Vice-President, Col. Lucius A. Salisbury, Medical Corps, New York National Guard; Second Vice-President, Assistant Surgeon General Warren F. Draper, U. S. Public Health Service; Third Vice-President, Col. Edgar Erskine Hume, Medical Corps, U. S. Army; Fourth Vice-President, Col. Irvin Abell, Medical Reserve, U. S. A.; Fifth Vice-President, Dr. Martin L. Cooley, Veterans' Administration; Secretary, Col. James M. Phalen, U. S. A. (Ret.), and Executive Secretary, Stuart E. Womeldorph.

Notice

When the May issue of the *Tri-State Medical Journal* is in the mails we will discontinue publication for the duration.

The demands of the armed forces on our medical personnel make this step necessary. — *Tri-State Medical Journal.*

Dr. Edward A. Strecker of Philadelphia Named Special Consultant in Psychiatry to Secretary of War Stimson for Army Air Forces

Dr. Edward A. Strecker of Philadelphia, Pa., President of the American Psychiatric Association, has been named Special Consultant to the Secretary of War for the Air Forces of the United States Army, according to an announcement today by the Committee on Public Education of the American Psychiatric Association.

In this capacity, Dr. Strecker will act as advisor to War Secretary Henry L. Stimson on all questions relating to psychiatry in the Air Forces. Serving as a civilian advisor, Dr. Strecker will be on call at all times by the War Department.

The appointment marks the second special consultant's post for Dr. Strecker. A month ago, he was named Consultant in Psychiatry to the Surgeon General of the U. S. Navy, in which capacity he acts as advisor in psychiatry to the Navy's Bureau of Medicine and Surgery.

Dr. Strecker recently established the first intensive training school for naval medical officers in Philadelphia. All of the medical and hospital facilities throughout the city are cooperating in this program, three months in length, which ha

already graduated more than a score of officers. A third class is in training.

Dr. Strecker has had extensive military experience. In World War I he held the rank of Major in the Army Medical Corps, as division neuropsychiatrist for the 28th Division in France. He became known as an authority on the military psychiatric disability formerly known as "shell shock."

Dr. Strecker is professor and head of the department of psychiatry at the University of Pennsylvania's Graduate School in Philadelphia, and the Medical School of the same university. He has been medical and clinical director of the Pennsylvania Hospital's Department of Nervous and Mental Diseases since 1917. He is chief of service and consultant at the Institute for Mental Hygiene of the Pennsylvania Hospital, and consultant for Bryn Mawr College and the United States Veteran's Bureau.

As President of the American Psychiatric Association, the oldest association of medical specialists in the country, he will preside at that group's centennial anniversary next spring in Philadelphia, site of the Association's founding.

Manpower Shortage and War Casualties to Be Chief Concern of Teachers College Rehabilitation Center

Refitting the handicapped for active participation in industry to swell the manpower pool and reconditioning war casualties will be the chief concern of the Rehabilitation Service Center at Teachers College, Columbia University, established after nearly two years of intensive study and research into the problems of the disabled, Dr. Herbert Bruner, executive officer of the Center, explained today, announcing the program which Teachers College will offer present and prospective rehabilitation workers starting with the summer session. "In view of the significance of the rehabilitation problem to all the American people, the entire resources of Columbia University and its cooperating institutions have been marshalled for the immediate training of rehabilitation workers and for long range investigations," said Dr. Frank D. Fackenthal, Provost of Columbia University.

Mr. Terry Foster, Research Director of the Vocational Rehabilitation Division of the U. S. Office of Education, who will assist in teaching the courses this summer, estimates that at the beginning of this year 1,300,000 disabled civilians were unemployed through lack of proper rehabilitation services. War casualties will approximate 100,000 per year, he feels. "The task of training is an overwhelming one," said Mr. Foster. "Literally thousands of trained workers are needed in the field."

"It is a double job," Dr. Bruner added. "We must rehabilitate men and women to help win the war in industry and agriculture and at the same time, it is imperative that every war veteran be provided with speedy and effective rehabilitation." For the first time in the history of the country, he pointed out, employers are demanding competent rehabilitated workers to meet the manpower shortage. "Men and women who are physically impaired, if they are vocationally prepared, can enter industry on an equal footing with the average normal person," he declared. "Yet at the present time there are approximately only 500 workers in the United States properly qualified to do rehabilitation case work. We hope through the Rehabilitation Service Center to assist in training the thousands more needed."

Teachers College will offer this summer short, intensive periods of training, carrying full Academic credit varying from three to six weeks, to prepare the much-needed personnel for both the program conducted by the Veterans' Administration, authorized by the Clark-Walsh Bill, and the civilian program now under the Vocational Rehabilitation Division of the U. S. Office of Education. The work will consist of practical instruction, demonstration and application. Topics which will be included in the program are diagnosis, vocational counseling, training, correct placement and follow-up. Work in special disability areas such as the orthopedic, the blind, and the deaf, under the guidance of Dean Willard C. Rappleye of the Columbia College of Physicians and Surgeons, will be offered in the clinic, hospitals and therapeutic workshops of leading institutions in the metropolitan area.

Rehabilitation Center in Boston

As a part of a broad program designed to restore injured workers to complete physical, mental and occupational abilities, the Liberty Mutual Insurance Company has established The Rehabilitation Center at 691 Boylston Street, Boston.

The Rehabilitation center has been established to provide actual rehabilitation treatment for the patients who can be accommodated, together with complete facilities for extensive research in physical therapy and occupational therapy. It is intended to serve as a laboratory for physicians and surgeons as well as a clinic for practical treatment. Establishment of this center in time of war is a timely coincidence. It is the hope and purpose of the founders that rehabilitation will continue in peacetime as a growing contribution to men and women engaged in industry, to American industry and to the medical profession.

National Association for Nursery Education

The National Association for Nursery Education is planning its biennial conference in Boston, Massachusetts, at the Statler Hotel, October 22 to 25, 1943. The theme of the conference is community services for children—in war and peace. This week end meeting will give special consideration to the valuable contributions made by various organizations in national state and local planning for children.

More About Physical Therapy Scholarship

The May issue of the ARCHIVES carried an announcement from the Chairman of the Committee on War Work of the Pi Beta Phi Fraternity, stating that that fraternity had decided "to set up a number of scholarships available to college women for training as physical therapy aides." May we repeat that the stipend of $400.00 may be used by the beneficiary for tuition or for living expenses, as she sees fit, since some of the approved schools offering this course charge tuition and some do not. All applicants must be approved by Deans of Women and submitted to Mrs. Geraldine Mars Ristine, Chairman, Committee on War Service of Pi Beta Phi, 400 East Washington Street, Mt. Pleasant, Iowa.

"Cosmic Ray" Sold in Health Devices

Three Chicagoans and a Danville couple were named on May 21 in indictments charging conspiracy and operation of a confidence game by allegedly selling "cosmic ray" tubes for $300, the Chicago *Tribune* reported, May 22. Those indicted by a Vermilion County grand jury were George Erickson and I. B. Haviland, who gave their address as 30 North La Salle Street, Chicago; Robert E. Nelson, Chicago, and Mr. and Mrs. George Brown, operators of a Danville health institute. John Allen, assistant state's attorney, said the defendants sold pencil-like tubes to the sick, claiming they were a "radioactive" development in healing. Allen said the tubes were analyzed and found to contain nothing that would produce radioactivity.

Walter P. Grimes, 1872-1943

It is with regret that we announce the death of Walter P. Grimes of Kansas City, Missouri. Dr. Grimes graduated from the University Medical College of Kansas City in 1901 and was licensed to practice medicine in Missouri the same year. He was a Fellow of the American Medical Association and was for many years a member of the American Congress of Physical Therapy.

HOTEL RESERVATIONS FOR ANNUAL SESSION

Make your hotel reservation now for the annual session to be held at the Palmer House, Chicago, September 8, 9, 10 and 11, 1943.

BOOK REVIEWS

THE 1942 YEAR BOOK OF INDUSTRIAL AND ORTHOPEDIC SURGERY. Edited by *Charles F. Painter,* M.D., Orthopedic Surgeon to the Massachusetts Women's Hospital and Beth Israel Hospital, Boston. Cloth. Pp. 410, illustrated. Price, $3.00. Chicago: The Year Book Publishers, 1942.

This book contains abstracts of the available literature on orthopedic surgery and industrial medicine for the past year. The editor points out that much of the literature has had to do with war injuries; therefore the contents of the book may seem overtinged with "war coloring." This could hardly be avoided. The book seems to be well done in regard to the field covered. There are very few abstracts from the literature of European countries for obvious reasons, but many more abstracts of articles from the literature of South American countries appear than is usual.

The book is divided into two sections. Part I contains abstracts of articles pertaining to general orthopedic surgery and includes discussions of tuberculosis of the bones and the joints, osteomyelitis, paralysis, bone tumors, fractures and dislocations, operative technics, diagnostic procedures and treatment of traumatic and orthopedic conditions. Part II deals with industrial medicine and surgery. The editor points out in the introduction to this section the necessity for focusing more attention on the health of the industrial worker. He mentions that serious consideration is being given to the problem of maintaining the health of workers as well as to prevention of accidents and sickness due to industry. He states that accidents due to the various machines cause no unusual conditions but "one is astonished at the number of dangers from the inhalation of poisonous gases, some of which cannot even be suspected through any recognizable physical properties. Nor does anyone think of the dermatoses as being anything but personal annoyances, as a rule; but in industry so many are caused by handling irritating substances used in war that the time losses for which they must be responsible are considerable." The editor points out the need for closer supervision of the health of workers in the smaller plants, where physicians specialized in industrial medicine are not employed on a full time basis. In the section on industrial medicine and surgery, are abstracts of many articles on phases of this important subject, such as industrial health in wartime, industrial hygiene problems in war industries, physiology of work, chronic fatigue symptoms among industrial workers, aging as a problem of industrial health and the like. In the section on diagnosis are abstracts of articles pertaining to the more recent medical and surgical problems arising from the use of new high-speed machines and chemicals now in use in the industries of war.

Anyone interested in industrial medicine and orthopedics should profit by use of this well prepared abstract of literature.

RELAXATION. By *Josephine L. Rathbone,* Associate Professor of Physical Education, Teacher's College, Columbia University. Cloth. Pp. 156. Price, $1.75. New York: Bureau of Publications, Teacher's College, Columbia University, 1943.

This is an excellent review of tension, its causes and technics for its release. This important subject is dealt with in six chapters. The signs and symptoms of tension are described in the first two chapters. Chapters three and four present the physical and psychologic factors involved. The rest of the book takes up the physical and psychologic methods of treatment.

Professor Rathbone is an authority on physical education and has given us many valuable contributions on both the physical and psychologic aspect of tension and its treatment. She recognizes tension as a somatic disturbance in some cases, but the greatest number of cases of pathologic tension are a result of fatigue or an unbalanced life, be it work, play, love, or worship. The chapter on rhythmic exercises, Hatha Yoga, and Jacobson's relaxation technic shows there interesting attempts to release tension. The Asanas exercises of Yoga combine mind and muscle better than anything our Western civilization has to offer. The writer's discussion on insomnia is practical and comprehensive. This book is highly recommended to everyone who is interested in his own welfare. It should be made compulsory reading for every course in personal hygiene. Our present war effort affects everyone from childhood to old age. The tension of living will increase and Rathbone's book on relaxation fills a real need in the world today. It should be read by everyone who is able to read.

PAIN MECHANISMS. A Physiologic Interpretation of Causalgia and Its Related States. By *W. K. Livingston,* Lieut. Commander, M.C., U. S. N. R. Cloth. Pp. 253. Price, $3.75. New York: Macmillan Company, 1943.

This book particularly deserves the attention of every medical man serving the armed forces. The author has divided the subject matter into three sections: section one, preclinical data which deals with the necessary anatomy and physiology of the central nervous system; the second section discusses the clinical syndrome of causalgia, phantom limb pain, facial neuralgias, post-traumatic syndromes and chronic low back disability; section three is given over to interpretations of protopathic pain, hyperalgesia and the sympathetic component. The subject matter is presented in simple interesting language that enhances its value. It is well written from the

clinician's viewpoint. An especially valuable chapter is the chapter on causalgia and reflex paralysis. The book has an excellent bibliography. This volume should be in the hands of all physicians but it is especially recommended for those medical men in the armed service. It is an essential book for those physicians dealing with nerve injuries. Industrial surgeons should welcome this treatise. Unfortunately the writer does not give a great deal of detailed information about physical therapy but its role in treatment is discussed.

A REVIEW OF MEDICINE. By members of the Faculty, Northwestern University Medical School. Edited by *Benjamin Boshes,* M.D., M.S., Ph.D., Assistant Professor of Nervous and Mental Diseases, Northwestern University Medical School; Major, Medical Corps, United States Army. Price, $9.50. Fifth Edition, Revised and Enlarged. Cloth. Pp. 712. Chicago, Illinois: Northwestern University Press, 1942.

The fifth edition of this popular review now includes references to war medicine, such as treatment of wounds, also the employment of the newer drugs. It maintains its status as a welcome volume of "meaty" and practical compilation of data most useful to the medical student and the busy practitioner. The principal chapters are: General Medicine, Special Lectures in Medicine, General Surgery, Special Topics in Surgery, Obstetrics, Gynecology, Genito-Urinary Surgery, Orthopedic Surgery, Fractures, Pediatrics, Otolaryngology, Ophthalmology, Neurology, Dermatology. The general scheme of presentation of each subject includes definition, etiology, pathology, symptomatology, diagnosis, prognosis and treatment; all this is so printed that it enables quick, easy review.

OUR AGE OF UNREASON. A STUDY OF THE IRRATIONAL FORCES IN SOCIAL LIFE. By *Franz Alexander,* M.D., Director, Institute for Psychoanalysis, Chicago; Associate Professor of Psychiatry, University of Illinois, College of Medicine. Cloth. Pp. 371. Price, $3.00. Philadelphia and New York: J. B. Lippincott Company, 1942.

We are witnessing wholesale destruction of life and property midst an era of utmost scientific enlightment and technical achievement, which if intelligently used, could render the life of all inhabitants of the earth more carefree than ever before. The dominance of irrational forces in human nature has perhaps never been as complete as it is in the present moment. No wonder that according to the author a confused world turns towards psychiatry for an explanation. The mastery of man has proven more a curse than a blessing in the hands of men ignorant of their own personalities and of human relations. This is the chief motif of the volume as expressed in the introductory chapters. The author is well qualified by his background and by a world-wide horizon to fully develop this theme. Born as a son of a distinguished historian and philosopher, of European fame, Bernard Alexander of Budapest and having served as a pupil of Sigmund Freud, the author was transplanted to the United States some thirteen years ago. In Europe he saw the world of his youth rapidly disintegrate and a cultural epoch to give way to a chaotic sense of insecurity, fear and distrust among mechanically minded men. In the United States, he sensed the freshness of a youthful world, full of energy but as yet unsure of itself, hectically competitive and always on trial. In contrast to the psychoanalytic material abroad, here he found as the most common conflict of the American neurotic the thwarted ambition among people trained to admire individual achievement yet situated in a standardized industrial civilization which imposed uneventful routine and offered no real security in return. There are three main parts in the volume: From Reason to Unreason, The Fundamentals of Human Behavior and From Unreason to Reason. The author endeavors to solve the problem by leading up to a new social outlook requiring an educational development of psychologic attitudes which are not yet universal and which challenge the philosophy of violence. There is much interesting recent historical material in the book, the style of which is lively, yet scholarly. Alexander's volume is timely and should make absorbing reading for every one.

INTRODUCTION TO PSYCHIATRY. By *W. Earle Biddle,* M.D., Senior Physician, Warren State Hospital; Instructor, Affiliated School of Nursing, Warren State Hospital, Warren, Pennsylvania; and *Mildred van Sickel,* B.S., R.N., Instructor of Nurses, Warren State Hospital, Pennsylvania. Cloth. Pp. 358, with 38 illustrations. Price, $2.75. Philalelphia and London: W. B. Saunders Company, 1943.

The title of this book might suggest that it is another text on psychiatry dealing with classification of mental disease, definitions and theories. Actually, it does include this type of information but, more important, it deals practically with real situations that are encountered by nurses, social workers and attendants who care for the psychiatric patient. Therefore it is written for, and suited admirably to the needs of, nurses and other workers dealing with these problems.

The book is well organized. It is divided first into sections, then into units and finally into chapters. This permits easy reference to any particular topic. In the first section, under Unit I, which is called "Orientation to the Nursing Service," the opening chapter deals with the mental hospital. Under this, such topics as attitudes concerning the hospital, the patient, visitors anl relatives are considered. The approach is completely realistic and worth study. In a similar manner, the care of new patients is discussed in another chapter. A third chapter deals with special psychiatric problems in regard to feeding, elimination, destructive tendencies and so on.

Unit II is called "Special Therapies in the Treatment of Psychiatric Disorders." The subjects dealt

with under this heading are general medical care; psychotherapy; occupational, recreational and physical therapy; narcosis; fever and shock therapy.

Section II deals with psychiatry in relation to psychiatric nursing. In this section, a history of psychiatry has been included, with a chapter each on the etiology and symptomatology of mental disease. Another part is devoted to psychiatric disorders with clear expositions of functional psychoses and organic psychoses. A final unit deals with psychiatry and the community, including such topics as legal considerations, prevention of mental disease and psychiatric schools of thought.

Numerous cases are presented each of which is analyzed in so far as treatment, prognosis and prevention are concerned. The descriptions of the cases and patients as well as the suggestions for handling each situation are very good. The book is written in a simple, graphic style. This text should be invaluable to nurses since the emphasis on the understanding of the patient is stressed as much as, if not more than, the actual treatment of the patient. It is highly recommended as a textbook for any workers, nurses and workers not educated in the medical school particularly, who are in contact with patients having mental disorders.

NEUROMUSCULAR MATURATION OF THE HUMAN INFANT. By *Myrtle B. McGraw*, Associate Director, the Normal Child Development Study Department of Pediatrics, Columbia-Presbyterian Medical Center, Columbia University. Cloth. Pp. 14, 140 illustrations, 27 diagrams and graphs. Price, $2.00. New York: Columbia University Press, 1943.

In this book are presented clearly and concisely the salient findings of studies carried on for more than ten years on the emerging common patterns of infantile motor behaviour and sensory development and their correlation with sequential changes in the cerebral cortex.

The first chapter, "Structural Foundations of Behaviour," based as it is on relatively recent histological and cytologic studies of the brain and nervous system of the infant and young child, and setting forth the working hypothesis of Dr. McGraw's evaluation of experimental results, is in itself a valuable contribution to our understanding of infantile behaviour. The following chapters give detailed descriptions (with diagrams) of the maturation changes and stages in motor behaviour and show their correlation with those occurring in the neural system and cerebral cortex. They are well and objectively done. In the last chapter, "Maturation and Learning," Dr. McGraw arrives at the conclusion that "Maturation and learning are not different processes, merely different facets of the fundamental process of growth" and suggests that "behaviour criteria can be established as guides for the introduction of all subject matter" in education, based on "behaviour 'signals' or 'syndromes' which reflect the maturity of neural mechanism." This seems to the reviewer an over-simplified view with regard to the problems of learning and education in the purely intellectual field, as contrasted with learning in the field of bodily functions. The chapter is, however, highly prevocative for the re-thinking of educational problems along the lines of behaviour maturation, ultimately, perhaps, on a sounder basis than has characterized certain similar efforts of so-called "Progressive Education."

The duration of the studies, the auspices under which they were carried on, the methods employed and the large numbers of infants studied contribute to the authenticity of the conclusions drawn with regard to the experimental work. The book can be highly recommended on the score of its interest and usefulness to all whose professions have to do with the growth, development and problems of young children.

QUESTIONS AND ANSWERS, VOLUME 2. THE QUESTIONS AND ANSWERS IN THIS BOOK HAVE BEEN SELECTED FROM THOSE PUBLISHED IN *The Journal of the American Medical Association*, DEPARTMENT OF QUERIES AND MINOR NOTES IN 1940, 1941, AND 1942. Cloth. Price, $2.00. Pp. 449. Chicago: American Medical Association, 1942.

This volume is so organized that questions and answers which refer to one particular medical field are grouped together and therefore the questions are found easily. The table of contents makes it possible for the reader to turn quickly to the question which interests him. For instance, one of the topics is arthritis and rheumatism. Under this are listed questions and answers dealing with pyorrhea alveolaris and arthritis, vitamins and rheumatoid arthritis, climate and arthritis, sedimentation test in rheumatic fever, rheumatic fever and physical activity and fibrositis.

The questions were taken from letters which physicians had written to the *Journal of the American Medical Association* when seeking assistance in diagnosis or treatment. Naturally, the answers cannot be exhaustive, since space prohibits this.

How helpful this type of book can be to a physician can be determined only by his individual needs. The practitioner may find therein suggestions concerning new or altered concepts of diagnosis and treatment. The many discussions in the book may serve as excellent practical lessons for the medical student by indicating some of the many problems encountered in practice. In any event, the questions and answers are interesting and worth reading.

PHYSICAL THERAPY ABSTRACTS

The Role of Physical Therapy in the Rehabilitation of Disabled Soldiers. Ralph Pemberton.

Am. J. M. Sc. **204**:846 (Dec.) 1942.

There is one field of treatment in war medicine which has wide application to both the wounded and the medically ill to an extent hardly shared by any other significant group of measures; namely, physical therapy.

This truth is appreciated by few of the profession, though many as army and naval officers, will see it exemplified. Much will depend, in terms of soldiers and sailors invalided by trauma or disease, on the understanding which medical officers possess or may acquire of the principles involved.

The central agencies of physical therapy consist of the quartet of heat, massage, rest and exercise. With the exception of radiation in the nature of roentgen ray or from radium, little or nothing has been added, i. e., new in principle, since the days of Hippocrates, though facility of application and improved technics have made great strides. This apparently simple quartet of measures may potentially influence nearly all bodily processes, directly or indirectly and can be given either by systemic or local application. It is vitally necessary for those whose function it will be to order or direct these agencies to know something of the mechanisms of operation concerned. The use of heat, for example, cannot be intelligently applied without knowledge of what it accomplishes and the limitations involved.

Attention should be turned briefly to that member of the quartet constituting physical therapy coming under the head of exercise. As already mentioned, exercise, either local or systemic, is eventually accompanied by an acidosis due to the production of lactic acid by the contracting muscles. In contrast to the influence of massage, exercise affords the only means of developing muscle although it is true that massage will add greatly to the tone and firmness of muscle. During exercise the heart rate is accelerated, the circulation of the blood is increased, sweating may be induced and some of the phenomena in the capillary beds discussed under heat and massage may be brought about. The availability of these influences to the sick and wounded from active exercise is, of course, negligible.

Rest is as important in the exhibition of physical therapy as in the treatment of cardiovascular conditions or pneumonia, but rest is not the simple negation of activity popularly connoted by the term. The resting phase of muscular activity is an integral part of the muscular activity. Only trainers appreciate this relation in its entirety. Systemic rest accomplishes specific purposes which no other measures can bring about and should be so carried out as to promote these ends. Rest in recombency has the following consequences: 1, the avoidance of excessive blood flow to active areas permits of dilatation of capillaries elsewhere and the determination of blood to such regions; 2, this promotes even distribution of blood throughout the capillary beds; 3, the warmth of the bed clothes may further open up peripheral capillary beds; 4, these influences permit passage to tissue fluids into the vascular channels; 5, rest permits relaxation of the nervous system by releasing it from the maintenance of muscular tone; 6, allows ptosed and dysfunctioning organs to assume normal positions and functions; 7, reduces the metabolic load because the lowered energy outgo permits a lowered energy intake; 8, permits replacement of the metabolic deficiencies and removal of the surfeits constituting fatigue; 9, by removal of static strains, rest permits subsidence of inflammatory processes and enables the process of repair to succeed.

The medical states in which physical therapy has its greatest value can be enumerated in approximately the following order: 1. Arthritis, rheumatism, fibrositis, neuritis and muscular conditions constitute a field in which physical therapeutic measures experience some of their most brilliant consequences. 2. A wide field of applicability of physiotherapeutic measures in general is to be found in disabilities of the nervous system, ranging from paralysis to the true psychoses. 3. The next most frequent group of diseases to which physical therapy is applicable under war conditions falls under the general head of cardiovascular conditions. 4. Another exemplification of the same principle is to be seen in the use of heat, massage, and the so-called vascular boot to peripheral disease of the blood-vessels.

Conservatism in Orthopaedic Surgery. T. P. McMurray.

Clin. J. **80**:97 (May-June) 1942.

A considerable number of patients studied suffered from low back pain. In each clinic the greatest care was exercised in the examination of all the abdominal and pelvic organs for any abnormality which could possibly lead to a complaint of pain in the back. If no abnormality was discovered during these examinations, the methods of treatment adopted in the two clinics was so different as to be startling.

In the one clinic the surgeon in charge had been struck by the number of these patients in whom a considerable increase in the normal lumbar curve could be observed. He demonstrated also that the assumption of the erect position was almost invariably accompanied by

a still further increase of the lordosis. He did not claim that in all patients the pain could be explained by the loss of alignment, but he showed the improvement which could be effected in a considerable proportion by correction of such errors when present. Improvement in posture was rapidly produced by a few simple exercises, which were conducted under the supervision of an intelligent instructor. The results were surprisingly good and in the large majority it was found unnecessary to perform any of the severe operative procedures which are not always successful in relieving the pain.

In the other clinic the effects of posture were ignored, attention being almost entirely devoted to a careful examination of the exact area of tenderness and to the localization of the areas of referred pain, following which treatment consisted in elaborate operations on the bony skeleton or on the central nervous system.

It would be unwise to suggest that these two groups of patients were suffering from exactly the same conditions, but the differences in the treatment were so obvious that one naturally wondered as to their respective value. In the first group operations formed a small part of the routine, while in the second—although massage was employed—it was obvious that little benefit was expected from its use and as a consequence improvement by this means was the exception.

Here, the author believes, is an important principle which runs through the whole of orthopaedic surgery: pain and disability may, and do follow on mal-alignment, whether this be of the trunk or of the lower limb. The bad effect of the abnormal weight-bearing may not appear for months, or even years, but the predisposing cause is present and unless corrected mal-alignment will inevitably cause disability.

The Therapeutic Value of Ultraviolet Radiation. Report of Council on Physical Therapy.

J. A. M. A. **120**:620 (Oct. 24) 1942.

The Council on Physical Therapy recognizes the place of ultraviolet radiation therapy in medical practice.

Ultraviolet irradiation with wavelengths shorter than 3,130 (particularly 2,967) angstroms exerts an influence on calcium and phosphorus even when the diet is adequate. But of even great importance from the standpoint of protection against dietary deficiencies is the action of ultraviolet radiation in rectifying partial lack of the components necessary for proper calcification of bone and teeth.

Both natural and artificial ultraviolet radiation are of definite value in the treatment of some forms of tuberculosis. There is still considerable difference of opinion on which regions of the light spectrum are most efficacious as well as confusion as to the tuberculous conditions that respond best to this treatment.

For uncomplicated pulmonary tuberculosis, no clinical evidence is at hand to prove the indication for ultraviolet radiation.

Pleural tuberculosis, dry or serous, especially if it is the initial clinical manifestation, is occasionally aided by ultraviolet therapy. The acute serous form is not to be irradiated. A tubercular pleurisy with no obvious pulmonary disease usually responds to ordinary rest and hygienic-dietetic treatment; cases not responding after about a month of such treatment may call for irradiations.

Laryngeal tuberculosis is practically always secondary to pulmonary tuberculosis, so that the indications for the treatment of the larynx depend upon the nature of the disease in the lungs. Here again ultraviolet by itself is not curative but exercises its part only as an adjuvant to the other mainstays of treatment. General ultraviolet light exposures are made to the body, with at times additional laryngeal local exposures.

Tuberculous lymph nodes may be seen clinically in three different stages; namely, as enlarged nodes which have undergone hyperplasia, as nodes which have proceeded to the stage of caseation and softening, or as softened nodes which have perforated to the exterior through a sinus tract. In the first stage, general body exposures to repeated erythema doses of ultraviolet radiation are not infrequently followed by an inflammatory reaction at the nodes with slight pain, tenderness and swelling. In the majority of cases the inflammation subsides and the lymph node finally heals. Occasionally, nodes in the hyperplastic stage may become caseous under light treatment and at times may have to be treated surgically by excision. In such instances ultraviolet radiation is of great value when used postoperatively in preventing the formation of tuberculous sinuses. In the second stage of caseation, light exposures alone will frequently bring about resolution. When softened lymph nodes reach the stage of fluctuation, aspiration or incision is necessary, and then light is most effective. In the third stage, excellent results are obtained in clearing up sinuses of long standing, but occasionally roentgen exposures may have to be combined with light treatment for complete healing to take place.

Secondary ulcerative intestinal tuberculosis is the most frequent complication of pulmonary tuberculosis, occurring in from 50 to 80 per cent of the patients who die of pulmonary tuberculosis as revealed by necropsies.

Artificial light and solar therapy, as well as a rich vitamin diet, should be used in most cases, as they frequently relieve the symptoms and bring about recovery.

In peritoneal tuberculosis, ultraviolet therapy always deserves a trial first.

If unilateral renal tuberculosis is diagnosed at the very onset of symptoms and when such symptoms are slight, conservative treatment with ultraviolet radiation has on rare occasions prevented the need of surgical intervention.

In bone and joint tuberculosis, heliotherapy, although not the mainstay of treatment, is always employed in combination with other forms of therapy. Orthopedic measures, rest in the open and light form the basis of conservative therapy. Combined conservative treatment includes ortho-

pedic measures, such as immobilization of joints, traction and careful use of passive and active motion, use of ultraviolet air, tuberculin and diet and judicious application of surgery.

Ultraviolet ray therapy is indicated in various other forms of tuberculosis. Many manifestations of cutaneous tuberculosis respond well to ultraviolet irradiation. — (Reprinted with permission.)

Rheumatic Diseases. G. R. P. Aldred-Brown.

Practitioner **149**:209 (Oct.) 1942.

The cause of rheumatoid arthritis remains unknown, but focal infection still holds the lead in the various hypotheses. The many cases in which attention to a septic focus in tonsils, antra, or teeth, is followed by what appears to be a complete recovery from the disease, is sufficiently impressive to keep this hypothesis to the forefront.

The carbohydrate should be low, because excess carbohydrates fail to secure an adequate vitamin intake from other foodstuffs and, further, such carbohydrate has an unfavorable effect on the low grade edema which they say is sometimes present.

There appears to be agreement on the value of gold salts in rheumatoid arthritis. Despite the better results claimed from large doses, the tendency to use smaller doses to avoid reactions is increasing.

In war time, rehabilitation of the disabled soldier and industrial worker is of vital importance; it is essential that they should be restored to full working capacity as soon as possible. As pointed out by Jones, it is much easier to carry out occupational therapy in war time than in peace time, when the economic factor presents a grave problem. The value, however, of this therapy has been so proved that a solution of the difficulties must be found after the war. Occupational therapy has a definite value from the psychologic point of view, as well as keeping joints supple and strengthening wasted muscles. Ideally every patient, bed or ambulatory, should be given some occupation, preferably one which needs coordination of both muscles and brain. Moreover, Jones considers that the best results are obtained when the patient feels that he is working in his own interests, making something for himself, his home or his own profit. Physical therapy, especially hydrotherapy, has again been advocated by many recent writers as the treatment of choice for this condition. A considerable increase in mobility and a decrease in pain is obtained by getting the patient to do exercises for the hip while lying on the bed each morning; such as flexing the hip with the hands, assisting the flexed knee to approximate to the chest, abduction and rotation of the extended leg, and adduction across the other leg. The exercises should be done rhythmically with a pause and relaxation between each movement, until each exercise has been completed a dozen times. Osteoarthritis of the knees so often occurs in women with a tendency to obesity at or near the menopause that it has been called menopausal arthritis. Many of these women will be relieved of their pain by adjusting the mechanics of their feet, possibly a lift on the sole and heel of the shoes, or arch supports, either of rubber or soft leather. Properly fitting shoes with sufficient grip around the ankle and a wide heel should be insisted on.

In the group with fibrositis is undoubtedly by far the largest number of patients of rheumatism that the physician is called on to treat.

The basic principle of treatment remains the same—"rest, warmth, purgation, sweating, and massage." Massage, preferably after the application of heat, should aim at breaking up the fibrous nodules. Considerable success is claimed for the injection treatment of these nodules and tender spots. It must be remembered that with inflammation of fibrous tissue in or around muscular tissue, the pain produced may be referred to another structure some distance away rather than in the site of the muscle itself.

Physical Treatment of Acute War Neuroses. William Sargant.

Brit. M. J. **4271**:574 (Nov. 14) 1942.

If severe anxiety or hysterical symptoms have continued for even a week or longer, other treatment is necessary which cannot be done except in hospital, though not necessarily far from the scene of fighting or bombing. By this time physical changes will have become more pronounced and conditioned fears will have taken a firmer hold. A much longer period of sleep treatment is necessary to destroy these. Any sedative drug can be used.

Among the other good personalities that may break down, especially after three years of war, there are many patients who get sent either to neurosis centers or to mental hospitals. Included among them are the over-conscientious non-commissioned officer with many years' service and the valued industrial worker who are particularly prone to break down into a depressive state because of their previous conscientious obsessional personality. Such patients carry on till they are sleepless, retarded, have ideas of guilt, or blame themselves for failing in their excessively high standard of duty or for letting down their comrades or superiors. These patients do not respond well to modified insulin therapy; despite a large intake of food they do not put on weight. Metabolic changes have occurred which are difficult to reverse and are reflected not only in a depressed attitude of mind but also in a general slowness of bodily movement, easy fatigability and retardation of thought, speech and even facial expression. Sometimes this distressing condition can be broken up by a long course of continuous sleep treatment lasting up to three weeks, but this will occur in only a relatively small proportion of the patients treated. One may have to wait a month, a year or even longer for spontaneous recovery to occur, even if the patients are immediately discharged from the Army or removed from stress. They are inaccessible to

psychotherapy or reassurance. Convulsion therapy, however, should produce a rapid improvement in up to 75 per cent of those patients with a good previous personality and genuine severe depression. Such treatment carries with it a slight risk of fractures, but has not the far from negligible mortality of a long course of continuous narcosis in inexperienced hands.

Preparing for Physical Therapy. Franklin P. Lowry.

Massachusetts Teacher **22**:18 (March) 1943.

While visiting a patient in a neighboring village several weeks ago, his daughter — learning that I was somewhat familiar with physical therapy — ventured the question of schools for training physical therapy technicians. During the conversation following, she produced a pamphlet advertising a commercial school of physical therapy having low standards. She said that this piece of advertising had been given to her by her high school advisor, and that she had decided to enter the advertised school.

After a brief discussion of the school's inception, its promoter, instructors, time and type of teaching, lack of opportunity for clinical practice, etc., she realized that it would be futile for her to expect anything but a disappointing position with the background of such a school and that she would never have an opportunity for advancement without further study. That talk changed the situation — for which she was most appreciative. This episode suggested to me that there might be other teachers and advisors not too well informed on this subject.

What, then, is physical therapy? What is a physical therapy technician's work, and what kind of education does she need? How much time should such a course require?

Physical therapy is the treatment of those illnesses and physical defects or injuries which cannot be properly cared for by drugs and surgery alone, by physical means. Physical therapy entails, then, the therapeutic use of light, heat, electricity, water, massage, and exercises.

The physical therapy technician carries out the treatment prescribed by a physician familiar with that type of work. Much is left to her ability as she, after all, is the one actually treating the patient.

Preceding her entrance into this field, high school laboratory courses in physics, chemistry, and biology are a real necessity. In order to carry on such work efficiently, the technical branch of her training must include a mastery of anatomy, massage, kinesiology, electrotherapy, hydrotherapy, and corrective exercises. She must also have a good understanding of some phases of neurology and orthopaedics and at least an acquaintance with the fundamentals of pathology, bacteriology and other less important but necessary subjects. During her course, except for the first few months when she is studying the basic subjects, it is of great importance that adequate facilities be provided in hospital clinics under competent instructors.

Such a program demands highly specialized instruction and is notably time-consuming — even though it contains nothing but the absolutely necessary requirements for actual work. In order adequately to accomplish such a program, at least two years are required, with the intervening summer spent in a hospital clinic. A shorter period of training is utterly inadequate for the pupil who desires a successful career.

An education which will continue to make its inadequacy felt throughout life is a poor investment. Therefore, pupils should be advised to attend only those schools fulfilling the requirements of the American Medical Association. You teachers and advisors are often a vital factor in moulding the future careers of your pupils. Many a youngster will be grateful to you for insisting that she obtain the best foundation in whatever field she finally decides to follow.

Activity in Rehabilitation. Sir Robert Stanton Woods.

Brit. M. J. **4272**:610 (Nov. 21) 1942.

When a member of the rescue squad gingerly removes the debris from the limbs of the entombed air-raid victim or a stretcher-bearer picks up the wounded soldier, he takes the first step in a long series of activities destined to rehabilitate or restore to health the casualty he has rescued.

With the extension of modern rehabilitation facilities came the widespread realization that physical measures for restoring function—massage, electrical stimulation, remedial movement—must, to be effective, be applied early, in many cases from the beginning of treatment.

But as soon as the patient can move the injured part with safety, such purely local and passive measures of restoration may in the majority of patients be abandoned with advantage in favor of active therapy, since the muscle stimulus most potent for good is the one coming from the central nervous system. As the patient's muscles contract in voluntary effort they promote the blood and lymph flow and bring fresh supplies of nutrient fluid to the injured tissues by a much more physiological mechanism than that of artificial stimulation.

Quite apart from the economic fear, the dread of losing one's job, of having to be kept by relatives or by the State, even the merely temporary loss of use of an arm or leg can be accompanied by serious mental depression peculiarly inherent in this type of illness, since movement, one of the fundamental attributes of living matter, is as natural and necessary as breathing and eating. The patient becomes convinced that he is crippled, paralyzed; he will never be any good again. Once the disabled person can be shown that he can throw a dart or kick a football or hammer in a nail or work a loom almost

as well as the next patient and certainly better than he himself did yesterday, he is on the road to recovery, mental as well as physical. And now we are no longer dealing with an injured body, but with an injured person—body, mind, spirit.

Even stereotyped voluntary movements of the injured part alone, since they demand the patient's cooperation and introduce the element of selfhelp, are excellent psychologically. Of far greater therapeutic value are purposeful and productive movements of groups of muscles such as those required in the performance of games and handicrafts, or the resumption of Army training, where the creative and competitive instincts can be brought into action and the patient's attention is no longer focused on his disability but rather on his returning skill in achievement.

Passive therapy still has an important place in rehabilitation, but as soon as the injured part can be used at all the physician or surgeon in control makes his decision as to how far active therapy can be substituted. The earlier this can safely be brought about the more rapid the patient's recovery and the greater the saving in trained personnel.

The Effect of External Temperature on Shock. An Experimental Study. K. G. Wakim, and W. D. Gatch.

J. A. M. A. **121**:903 (March 20) 1943.

Shock is a type of peripheral circulatory failure which causes a profound disturbance in the physiologic mechanisms of the body and leads to a syndrome exhibiting, among its manifestations, hemoconcentration, oligemia and a generalized peripheral vasoconstriction. In these unparalleled times, when injuries resulting in shock are not limited to our armed forces in combat zones all over the globe but may also occur *en masse* in our civilian population as a result of air raids or industrial accidents, a thorough investigation and careful appraisal of some of the methods employed in the treatment of shock are most timely. In the treatment of shock the application of heat is too much stressed. The public, as well as the physician, uses heat in abundance in the treatment of shock from whatever cause. In first aid instructions one is taught to apply hot water bottles, hot bricks or heated stones to the extremities and sides of an individual in shock. That not only warmth but heat is recommended for the treatment of shock can be inferred from the warning expressed in books that great care must be taken to prevent the infliction of severe burns from the hot water bottles used on the person in shock.

From the evidence observed in the experiments, the authors learned that the application of heat or of cold greatly shortened the survival time of anesthetized animals in experimental shock, while the animals that were placed at room temperature and those placed on warm water bottles slightly above room temperature, after shock was produced, had a much longer survival time. An external temperature in the neighborhood of body temperature proved to be optimal.

Excessive heat will do harm to the shocked organism in several ways:

1. It will produce a widespread superficial vasodilatation and distribution of blood to nonessential parts and thus counteract the protective natural reflexes that brought about the peripheral vasoconstriction in the skin and neighboring tissues which are not so vitally in need of blood during the emergency of shock. This protective superficial vasoconstrictor reflex was brought about to serve the purpose of narrowing the capacity of the vascular tree to cope with the diminished blood volume (oligemia and hemoconcentration) in shock.

2. Excessive heat will increase the metabolism and the oxygen requirement of tissues. In the presence of an already existing anoxemia in shock, overheating the patient necessitates the utilization of more oxygen and hence leads to a more severe anoxemia, which will increase capillary damage and capillary permeability and may terminate fatally.

3. Excessive heat is likely to increase perspiration and consequently promote dehydration. The promotion of dehydration, in the presence of hemoconcentration and oligemia already existing in a state of shock, will create a vicious cycle the outcome of which will be a greater hemoconcentration, which is bound to lead to untoward effects.

4. The burns often produced when hot water bottles are applied to semicomatose patients are so familiar to the clinician that they need only be mentioned here.

The following are the physiologic mechanisms involved in the production of superficial vasodilatation as a result of application of heat to the skin:

1. The direct local dilator effect of heat on the blood vessels in the skin and neighboring tissue: This dilator reaction starts immediately and lasts as long as the heat stimulus remains in contact with the skin.

2. Central hypothalamic inhibition of vasomotor tone induced by the rise of temperature of the circulating blood: This takes place atfer the blood gets heated enough to stimulate the heat regulating center and persists until either the center fails or the heat is taken off and the temperature of the blood returns to normal.

3. Reflex inhibition of vasomotor tone: This includes the well known axon reflexes of the vessels of the skin and other types of reflexes.

All these points support the fact that the wisest thing to do with persons in shock is to avoid exposing them to cold by wrapping them in blankets, but too much heat is contraindicated and the wholesale use of hot water bottles around the body of the patient in shock should be condemned. The room of the shocked patient should be kept around 85 F., which is sufficient to give him a comfortably warm environment.

SCHOOLS APPROVED FOR TRAINING PHYSICAL THERAPY TECHNICIANS

By the Council on Medical Education and Hospitals of the American Medical Association *

Name and Location of School	Medical Director	Emergency Course: Entrance Requirements †	Emergency Course: Length in Months	Emergency Course: Classes Start	Emergency Course: Tuition	Emergency Course: Certificate, Degree, Diploma	Regular Course: Length in Months	Regular Course: Classes Start	Regular Course: Tuition	Regular Course: Certificate, Degree, Diploma
Children's Hospital, Los Angeles[1]	Steele F. Stewart, M.D.	a-b-c	6	FebAug	$200	Certificate	12	FebAug	$200	Diploma
College of Medical Evangelists, Los Angeles[1]	Fred B. Moor, M.D.	a-b-c	....	.....	.....	.....	12	JanJuly	$200	Certificate
University of California Hospital, San Francisco[1]	Frances Baker, M.D.	a-b-c	....	.....	.....	.....	12	Feb	$150	Certificate
Stanford University, Stanford University, Calif.[1]	Wm. H. Northway, M.D.	a-b-d[2]	7	Quart.	$286	Certificate	10	Quart.	$401	Cert. or Degree
Walter Reed General Hospital, Washington, D. C.	Capt. D. L. Rose, MC.	b	6	Quart.	None	Certificate	....	.....	.....	.....
Northwestern University Medical School, Chicago	John S. Coulter, M.D.	a-b-d	....	.....	.....	.....	9	JulyOct	$200	Certificate
State University of Iowa Medical School, Iowa City	W. D. Paul, M.D.	b-c	6	MarSept	None	Certificate	....	.....	.....	.....
Bouve-Boston School of Physical Education, Boston	Arthur L. Watkins, M.D.	HS	....Given in conjunction with Harvard				3-4 yrs.	Sept	$400 yr.	Dipl. or Degree
Harvard Medical School, Boston	Frank R. Ober, M.D.	a-b-c	6	June	$200	Certificate	9	June	$250	Certificate
Boston University Sargent College of Physical Education, Cambridge, Mass.	Louis Howard, M.D.	a-b-c	....	.....	.....	.....	24	JanOct	$435 yr.	Cert. & Degree
University of Minnesota, Minneapolis[1]	Miland E. Knapp, M.D.	a-b-c[3]	....	.....	.....	.....	12	Summer	$112[4]	Certificate
Mayo Clinic, Rochester, Minn.[1]	Frank H. Krusen, M.D.	a-b-c	6	Jan-July	None	Certificate	9	JanJuly	None	Certificate
Barnes Hospital, St. Louis	Frank H. Ewerhardt, M.D.	a-b-c	....	.....	.....	.....	9	Oct	$200	Certificate
St. Louis University School of Nursing, St. Louis[1]	Alexander J. Kotkis, M.D.	HS	....	.....	.....	.....	4 yrs.	JanSept	$250 yr.	Cert. or Degree
University of Buffalo School of Nursing, Buffalo[1]	George G. Martin, M.D.	a-b-c	6	FebSept	$420	Certificate	1-3 yrs.	FebSept	$350	Cert. or Degree
Hospital for Special Surgery, New York City[1]	Kristian G. Hansson, M.D.	a-b-c	....	.....	.....	.....	9	Sept	$300	Diploma
New York University, New York City[1]	William Bierman, M.D.	a-b-c	....	.....	.....	.....	9	FebSept	$396	Cert. & Degree
Cleveland Clinic Foundation Hospital, Cleveland	Walter J. Zeiter, M.D.	a-b-c	....	.....	.....	.....	9	Sept	None	Certificate
D. T. Watson School of Physiotherapy, Leetsdale, Pa.[1]	Jessie Wright, M.D.	a-b-c	....	.....	.....	.....	12	July	$200	Diploma
Graduate Hosp. of the Univ. of Pa., Philadelphia[1]	Wm. T. Johnson, M.D.	a-b-c	....	.....	.....	.....	12	Sept	$200	Certificate
Richmond Professional Institute, Richmond, Va.	T. W. Wheeldon, M.D.	a-d[5]	....	.....	.....	.....	9-12	Sept	$200-220	Certificate
University of Wisconsin Medical School, Madison[1]	Ernest A. Pohle, M.D.	a-b	6	FebSept	$96[4]	Certificate	12	Sept	$96[4]	Certificate

† Courses are so arranged that any of the entrance requirements will qualify students for training. a. = Graduation from accredited school of nursing; b = Graduation from accredited school of physical education; c = Two years of college with science courses; d = Three years of college with science courses; HS = High school graduation.

1. Male students are admitted.
2. High school graduates accepted for a four-year course leading to A.B. degree; students admitted quarterly and tuition is $143 per quarter.
3. Medical technology graduate with B.S. degree also admitted.
4. Nonresidents charged additional fee.
5. Those with degree from other colleges also accepted.

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MEETINGS OF PHYSICAL THERAPY ORGANIZATIONS

In these columns will be published information about meetings, election of officers, etc., of physical therapy organizations. New data should be sent promptly to the office of the Secretary, 2 E. 88th St., New York.

American Congress of Physical Therapy, 22nd Annual Session, Palmer House, Chicago, September 8, 9, 10, 11, 1943; **Instruction Course** to be held during the meeting; Dr. Richard Kovács, 2 East 88th Street, New York, Secretary. See announcements elsewhere this issue.

Connecticut Physical Therapy Society, meetings held in May and October at same time as the Connecticut State Medical Society. Dr. Karl Bretzfelder, 315 Whitney Avenue, New Haven, Conn., Secretary-Treasurer.

New England Physical Therapy Society; meetings at Hotel Kenmore, Boston on third Wednesdays from October to June; Dr. William McFee, 41 Bay State Road, Boston, Mass., Secretary.

Southeastern and Southern Sections, American Congress of Physical Therapy will meet in conjunction with the *Section on Physical Therapy* of the *Southern Medical Association*, Cincinnati, Ohio, November 16, 17 and 18, 1943. Dr. E. J. C. Hildenbrand, 4201 Fessenden St., N. W., Washington, D. C., Chairman.

Kings County Medical Society, Physical Therapy Section; meetings at 1313 Bedford Avenue, Brooklyn, bi-monthly on second Thursdays; Dr. Samuel A. Warshaw, 1373 Ocean Parkway, Brooklyn, N. Y., Secretary.

The Penna. Academy of Physical Medicine; meetings at the Phila. County Medical Building, 21st and Spruce Streets, third Thursday, alternate months, starting with January; Dr. Harold Lefkoe, 5217 North Broadway, Philadelphia, Secretary-Treasurer.

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